Nonresident Tuition and Human Capital Flows: Evidence from a Lottery

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Abstract

I use a randomized controlled trial to study how nonresident tuition affects where highly skilled workers eventually live and work. For every $10,000 of tuition relief, the university receives $1,903 from increased enrollment and loses $2,738 from reduced tuition, yielding a small $835 loss. Treated students are more likely to stay in-state 12 years later and eventually earn $25,302 more in present value within the local economy, showing that the university's profit-maximizing tuition level is suboptimal from the state's perspective. The effects are driven by higher retention of inframarginal students and by out-of-state U.S. nationals rather than international students.

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1 Introduction

Governments strategically enact policies to attract skilled workers (Adda et al., 2022; Prato, 2025), often targeting educated groups like nonresident college students for their in-demand entrepreneurial, innovation, and executive skills (Bernstein et al., 2022; Amanzadeh et al., 2024; Lee et al., 2024; Martellini et al., 2024). Extant research on nonresident students typically focuses on the short-run trade-offs between nonresident tuition fees and crowd-out of local residents from capacity constrained programs (Bound and Turner, 2007; Orrenius and Zavodny, 2015; Chen, 2021; Anelli et al., 2023), but questions about the longer-run labor market impact of nonresident tuition remain largely unanswered. Understanding these long-run effects is crucial, as any welfare analysis hinges on the extent to which eventual migration alters the composition of the labor market.

Recent research highlights the need for longer-run causal estimates. Higher fees for domestic nonresidents can misallocate students across institutions, reducing aggregate welfare (Knight and Schiff, 2019), while lower fees for nonresidents may encourage students to transition into the local labor force, generating fiscal and labor market spillovers (Beine et al., 2023). Yet, despite growing nonresident enrollment and the potential to shape skilled migration (Bound et al., 2020), universities' tuition decisions are often made without direct knowledge of longer-run, local labor market effects that matter for state and federal policymakers (Groen and White, 2004). In theory, differences between students' enrollment and migration responses to nonresident tuition create a wedge between the incentives of colleges and government. If there is a sizable population of inframarginal students, who choose to enroll regardless of tuition levels but only migrate at lower tuition levels, then the profit-maximizing tuition level chosen by colleges may be too high from the perspective of a social planner who also weighs the value of future tax payments.

Even absent direct estimates of how nonresident tuition shapes the labor market, colleges and universities are obligated to adopt a policy. Public institutions often price discriminate on residency to balance their competing short-run financial and academic goals, with the uncertain trade-offs resulting in remarkable heterogeneity in their approaches. Some, like the University of Zurich and LMU Munich, have uniform tuition regardless of a student's place of origin. Others like UC Berkeley and the University of Toronto price discriminate with supplemental fees even for domestic students from other national subdivisions. Understanding the causal effects of these choices requires exogenous variation in the fees of nonresident students, which is particularly difficult to come by at the individual-level given the scarcity of financial aid programs that target them.

I advance this literature by using a pre-analysis plan and data from a computer-randomized tuition waiver lottery implemented in 2012 at a major North American research university.[1] Under the lottery, 1,333 international and domestic nonresident students from 45 countries who were admitted to the university were randomly assigned waivers that would reduce nonresident supplemental tuition by 20,000 dollars, 30,000 dollars, or 40,000 dollars over four academic years.[2] Students were tracked for more than a decade through the labor market and migration by linking names, birthdates, and academic records to the universe of publicly available LinkedIn profiles and American citizenship records from L2's database of commercial data and state voter rolls. Individual-level random assignment in this setting is particularly important given that variation in nonresident tuition is often confounded by differences in admission or academic criteria.

I find that nonresident tuition has substantial effects on both short-run and long-run outcomes. Reducing nonresident tuition raises enrollment at the target institution and in the state where the target institution is located. For every 10,000 dollars of tuition relief offered, the university receives 1,903 dollars in additional profit through higher enrollment and forgoes 2,738 dollars due to lower revenue per student. The small net loss of 835 dollars is consistent with the idea that the university maximizes profits from nonresidents

[1]The campus is a member of the Association of American Universities (AAU), a group of 71 flagship research institutions in North America.

[2]Roughly one third of these students were American citizens or legal permanent residents at the time of college application. One fifth of all students who were "domestic nonresidents" – i.e. applicants who live in the United States, but are not authorized for in-state tuition – were not American citizens.

as part of its objective function. In the longer run, lower nonresident tuition increases the migration to the target state by roughly the same rate at which it increases short run nonresident enrollment. This is possible because lower tuition sharply raises the retention rate of inframarginal students, who enroll regardless of tuition levels but whose migration decisions are influenced by the cost of attendance. Such students' job search, major selection, risk tolerance, local labor market network, and borrowing constraints may be impacted by tuition waivers in ways that improve the value proposition of remaining in the local labor market. Because of these inframarginal students, the state sees an additional 25,302 dollars in present value of future earnings and 1,265 dollars in tax revenue for every 10,000 dollars in tuition relief offered.

The estimated increases in the present value of state and federal tax revenue substantially exceed the forgone profit of the university. The magnitude of this effect implies that crowd-out rates of native workers' earnings in the local and national labor market would have to exceed -0.44 and -0.68 for the net present value of tax revenue to equal foregone tuition. Subgroup analyses show that the benefit to cost ratio of offering tuition waivers to STEM majors and out-of-state American nationals is higher than that of non-STEM majors and international nonresidents. This heterogeneity implies that there are potential gains to both university profits and social welfare at the state and national level from price discriminating by major and between domestic and international nonresidents, rather than following the common practice of charging all nonresidents the same supplemental tuition fees.

This paper makes three contributions to the extant literature. First, it provides experimental estimates of the longer-run effects of nonresident tuition on skilled migration with heterogeneity between out-of-state and international nonresidents. Second, it quantifies the fiscal and labor market externalities of nonresident tuition, showing that universities' pricing decisions likely have implications beyond their own budgets through nonresidents' impact on local labor supply and wages (Kerr et al., 2015; Piyapromdee, 2021; Albert and Monras, 2022; Doran et al., 2022) as well as nonresidents' impact on labor demand and innovation

(Kerr and Lincoln, 2010; Peri et al., 2015; Dimmock et al., 2019; Azoulay et al., 2022; Brinatti et al., 2023). Third, it highlights how these effects interact with STEM immigration policies studied in extant work (Amuedo-Dorantes et al., 2020; Beine et al., 2023), shedding light on complementarities between reduced tuition and visa programs.

While the estimates in this paper focus on the direct effects of tuition waivers among admitted nonresident students, institutional decisions about pricing are made in tandem with admission. Unlike policies that expand nonresident enrollment by lowering academic thresholds, the lottery studied here varies tuition for students already admitted, allowing for causal identification on a clean willingness-to-pay margin. This distinction is important: reducing tuition can raise long-run retention of inframarginal students who would enroll regardless of fee levels and generate fiscal and labor market externalities with lower risks of displacing local students or changing academic standards. More generally, while any reallocation of institutional resources could in theory have general equilibrium effects on in-state students, the randomization studied here holds both instructional capacity and local enrollment constant, isolating the migration effects of tuition itself. As such, the results should be interpreted as partial equilibrium estimates that inform one dimension of the broader policy trade-off in general equilibrium.

On balance, my results show that nonresident migration can be as sensitive as enrollment to tuition fees, with serious consequences for public finance and labor markets. There are large asymmetries between the incentives of colleges and governments, with increases in local labor market earnings more than an order of magnitude larger than the loss of tuition revenue from targeted students. The response of skilled migration to tuition policies underscores a need for better coordination between universities and policymakers in their efforts to strategically relocate skilled workers. Given the large negative effect of tuition on the migration of inframarginal nonresident students, the long-run externalities of nonresident tuition for local residents are larger than what would be implied by assuming migration is a fixed fraction of nonresident enrollment.

2 Institutional and Economic Context

2.1 The Tuition Waiver Lottery

Per my data agreement, I provide details about the policy setting but do not disclose identifying information about the university implementing the experiment, called the "target university". The experiment in this paper was implemented by a member of the Association of American Universities (AAU), a group of North America's top 71 research institutions. The target university has historically price discriminated on residency, charging uniform supplemental nonresident tuition fees to both international and domestic nonresident students. There is effectively no distinction in tuition policy between these two groups, with in-state residency defined primarily by the location of a students' secondary school and the place of their legal guardian's home address. Roughly one third of nonresident students were either American citizens or permanent residents at the time of application. Nonresident students are usually ineligible for need-based or merit-based financial aid at the target university, with under 10 percent of the sample offered any grant funding.

For the 2012-2013 academic year, administrators at the target university were interested in identifying the enrollment response of nonresident students to supplemental tuition fees and planned a computer-randomized lottery to assign tuition waivers of varying magnitudes. No application was required for eligibility and no selection criteria were applied beyond a requirement that students be admitted to the target university. From the full sample of 3,000 to 4,000 admitted nonresidents, the target university used a random number generator in Microsoft Excel to select 1,333 students to enter a tuition waiver lottery.[3] The selected 1,333 nonresident students originated from 44 countries and the United States and were randomly assigned to receive waivers that would reduce nonresident supplemental tuition fees by 20,000 dollars (444 students), 30,000 dollars (444 students), or 40,000 dollars (445

[3]Unfortunately, administrators do not appear to have retained records on the students who were omitted from the lottery.

students) in nominal terms over the course of four academic years.[4] The number of students subject to the lottery was chosen such that tuition waiver offers summed to a total of 10 million dollars. No other fringe benefits were associated with the program and there were no requirements to maintain the waiver other than remaining enrolled as a full time student in good standing.

Students were notified of the tuition waivers in the Spring of 2012 alongside their admission decisions from the target university. They were also separately notified with another award letter mailed to their home address on the same day. None of the materials stated the reason they were offered the tuition waiver or notified students of the existence of a randomized control trial with several treatment arms. The tuition waiver was unanticipated and announced only after students had applied, affecting the interpretation of the identification strategy and modifying the policy lessons.

First, because the treatment occurred after the application stage, the enrollment effects estimated here likely understate the full impact of a publicly advertised waiver program: students who applied despite the high sticker price have a relatively higher willingness to pay and may be less price sensitive to tuition than the marginal applicant. As a result, the estimated costs are likely an upper bound and the long-run migration effects are likely the lower bound of the treatment effect of a salient, upfront tuition policy.[5] Second, the experimental variation stems from the size of the waiver rather than whether aid was offered at all and every student in the sample received a substantial discount. The estimated effects net out any fixed response to the surprise itself and isolate how outcomes respond to price. Hence, the margin studied here is precisely the lever institutions can adjust in the short run to meet enrollment targets, implement finer degrees of price discrimination, or respond to

[4]The sticker price of tuition and fees for nonresidents was roughly 150,000 dollars in nominal terms over four years. Approximately 2/3rds of this was nonresident tuition and 1/3 was mandatory fees that also apply to local resident students. The three treatment arms discounted tuition at rates of 13%, 20%, and 27% of total tuition and fees, or 20%, 30%, and 40% of nonresident supplemental fees, or 40%, 60%, and 80% of the baseline of local resident tuition and fees.

[5]We can say that my estimates are likely a lower bound on the enrollment effects of tuition because extant work on price transparency and application behavior finds that advertising aid earlier in the process increases applications and enrollment (Hoxby and Turner, 2015; Dynarski et al., 2021; Burland et al., 2023).

short-term budget pressure. Together, these features make the results a conservative but policy-relevant benchmark for universities. I return to this interpretation when discussing the implications for external validity and welfare.

No correspondence was necessary to claim the tuition waiver other than signalling intent to register at the target university before the college acceptance deadline and subsequently enrolling for the Fall 2012 term. If a student chose to enroll at the target university, their posted tuition fees would be reduced by the amount specified in their award letter when they entered their online payments portal. After this experiment, analysts at the target university concluded that the enrollment response of nonresident students to tuition prices was zero, citing a t-test from a small subsample of students. The tuition waiver program was discontinued in the following academic year.

This paper involves a secondary analysis of a computer-randomized RCT implemented by the target university in 2012. Prior to gaining access to any outcome variables other than target university enrollment, I pre-registered the project with a pre-analysis plan at the American Economic Association's RCT registry as AEARCTR-0013117 (Firoozi). I link original administrative data from the target university to high quality short-run enrollment records from the National Student Clearinghouse and longer-run outcome data from L2 Inc. and Revelio Labs. These pre-specified outcomes track students through immigration, employment, and the labor market.

2.2 Profit-Maximization and Optimal Price-Setting in Theory

Colleges and universities, especially public institutions, explicitly charge supplemental tuition fees to price discriminate between resident and nonresident students. They enact this form of price discrimination to generate "profit" from nonresidents that can then be used to cover other academic expenses or to cross-subsidize the cost of attendance for local resident students. In this regard, postsecondary institutions may be thought of as rational, profit-maximizing monopolists for the sale of their enrollment to nonresident students. They set prices (total fee levels) with an understanding that the quantity of nonresidents who enroll depends in part on the prices they set. We can construct their objective function as a simplified profit function with some abuse of notation below:

$$\underbrace{\pi}_{\text{Profit}} = \underbrace{(T - W - C)}_{\text{Profit Per Student}} \times \underbrace{Yield \times Admits}_{\text{Enrolled Nonresidents}}, \tag{1}$$

where π represents profit, T represents the total sticker price of tuition and fees for nonresidents including supplemental nonresident tuition, W represents the value of the waiver offered in the experiment, C represents the per student cost of instruction for nonresidents, $Yield$ reflects the fraction of nonresident admitted students who actually matriculate, and $Admits$ is the total number of nonresident students who were admitted to the college or university.

When colleges and universities offer waivers or discount tuition for nonresidents, the change in their total profit is theoretically ambiguous because of two competing effects that act on total profit. The relative magnitude of these effects determines the profit-maximizing level of nonresident tuition and depends on how price-sensitive the yield rate is to tuition. I take the derivative of Equation 1 to demonstrate this mathematically below:

$$\underbrace{\frac{d\pi}{dW}}_{\text{Total Effect}} = \underbrace{-Yield \times Admits}_{\text{Mechanical Effect}} + \underbrace{(T - W - C) \times \frac{d(Yield)}{dW} \times Admits}_{\text{Behavioral Response}}. \tag{2}$$

The total effect of a change in waiver size on profit can be decomposed into two competing effects: a mechanical decrease in profit margins and a behavioral increase in the yield rate. First, increasing the size of the waiver mechanically reduces profit by definition because it reduces the profit margin per nonresident student who enrolls. Second, there is the behavioral response of the yield rate to the waiver. Reducing tuition can increase the share of nonresident admitted students who actually enroll. These marginal nonresident enrollees will increase profit because they have a positive profit margin if it remains true that $T - W > C$.

By definition, an institution that is profit-maximizing in its choice of nonresident tuition will set fee levels such that the sum of these two effects are exactly equal to zero. Stated another way, the marginal profit from the waiver will be exactly equal to zero at the college or university's profit-maximizing level of nonresident tuition waivers. In practice, postsecondary institutions have imperfect information about the demand curve for their enrollment and may value nonresident enrollment for nonpecuniary reasons that lead to non-zero marginal profits.

Consider a simple example that illustrates the general principles in practice:

> Assume that a college admits 100 students who have a baseline yield rate of 10 percent and generate 20,000 dollars in profit per student for the college. The total profit generated by the college is equal to 100 students times a yield rate of 10 percent times 20,000 dollars of profit per student. The college generates 200,000 dollars in total profit.
>
> Now, assume that the same college admits the same 100 students, but offers a 10,000 dollar tuition waiver that increases the yield rate by 2 percentage points. Total profit is now equal to 100 students times a yield rate of 12 percent times 10,000 dollars in profit per student. The college now generates 120,000 dollars in total profit.
>
> The true cost of the program was 200,000 (the profit level without the waiver) dollars minus 120,000 dollars (the profit level with the waiver), which is equal to 80,000 dollars. The program issued 10,000 dollars of waiver offers to each of 100 students, which sums to a total of 1,000,000 dollars in offers. Therefore, for every 10,000 dollars of waivers offered to students, the program costs the college 800 dollars in actual profit.

In the example above, reducing nonresident tuition reduces profit. This means that the college's nonresident tuition level without the waiver is likely at or below the profit-maximizing level. If instead we observed profits rise in response to the tuition waiver, then that would imply that the baseline nonresident tuition level was above the profit-maximizing level. In effect, any result that is close to null implies a college or university is setting its nonresident tuition and fee levels close to the values that maximize the profit it recovers from nonresident students.

If we accept the economic and ethical premise that colleges and universities can use the information available to them to implement third degree price discrimination and maximize profits from nonresidents, then we encounter another wrinkle. Institutions can implement finer degrees of price discrimination between different groups of nonresidents to increase their profit relative to treating all nonresidents as a homogenous bloc with a single demand curve. In particular, colleges and universities differ in the practice of price discriminating between "out-of-state" American national nonresidents and "international" foreign national nonresidents. Should these two groups have significant differences in the sensitivity of their enrollment to the cost of attendance, a profit-maximizing institution would charge them different levels of tuition.

One final complication arises from the asymmetric incentives between a social planner and the college or university. A social planner operating at a state or federal level would not just care about short-run profit or cohort crowding; they would consider the long-run tax revenue from nonresidents who migrate and the associated labor market spillovers for local resident workers. Importantly, nonresident tuition waivers may increase eventual migration to the local labor market not only by inducing a greater number of nonresidents to enroll at the college or university, but by *raising the share of inframarginal nonresident students*[6] *who choose to remain* in the target state rather than return to their place of origin. This second mechanism through which tuition induces migration, called the "transition rate" (Beine et al., 2023), can accrue tax revenue for the social planner without being observable to or directly benefiting the college or university.

The social planner would seek to maximize some measure of welfare that incorporates

[6]Inframarginal nonresident students in this context are defined as nonresident students who enroll at the college or university regardless of tuition level they are personally charged.

both university profit and the net present value of nonresident students' longer-run contributions to state or federal finances. For simplicity, consider the following objective function:

$$\underbrace{\omega}_{\text{Welfare}} = \underbrace{(T - W - C)}_{\text{Profit Per Student}} \times \underbrace{Yield \times Admits}_{\text{Enrolled Nonresidents}} + \underbrace{\tau \times Migration \times Admits}_{\text{NPV of Tax Revenue}}, \tag{3}$$

where τ is the average net present value of tax revenue per nonresident who migrates and $Migration$ is the share of admitted nonresident students who eventually migrate. Maximizing aggregate welfare with this function entails setting the derivative of it with respective to waiver size equal to zero. In other words, the marginal change in social welfare per dollar of tuition waived will be null at the level of net tuition $(T - W)$ that maximizes social welfare. Mathematically:

$$\begin{aligned} \underbrace{\frac{d\omega}{dW}}_{\text{Marginal Social Welfare}} &= \underbrace{-Yield \times Admits}_{\text{Mechanical Effect}} + \underbrace{(T - W - C) \times \frac{d(Yield)}{dW} \times Admits}_{\text{Behavioral Response}} \\ &\quad + \underbrace{\tau \times \frac{d(Migration)}{dW} \times Admits}_{\text{Marginal Tax Revenue}} = 0. \end{aligned} \tag{4}$$

Notice that the social planner's problem resembles that of the college or university while also incorporating another positive term that captures the marginal long-run tax revenue nonresident student migrants bring to the host location. This means that the tuition level which maximizes profit for a postsecondary institution is lower than the level that maximizes the social planner's objective function, particularly if $\frac{d(Migration)}{dW}$ is large. It is possible that term is larger than even $\frac{d(Yield)}{dW}$ in part because changing the cost of attendance changes both the share of admitted students who yield to the university and the share of inframarginal enrolled students who choose to remain in the host location. If the migration response of foreign national nonresidents is different than American national nonresidents, then that would again rationalize using tuition levels to price discriminate between groups from the social planner's perspective.

3 Data and Methods

3.1 Data

This paper links four primary data sources at the individual level to track students from the time of their college applications, which were originally submitted in late 2011, through their longer-run outcomes in late 2024. I start by using administrative records from the admission and financial aid offices of the target university, which were retained for program evaluation. Records are then linked to National Student Clearinghouse data on the college enrollment history of students. Information on citizenship, labor market outcomes, and location come from the universe of American voter registration records supplied by L2 Inc. as well as the universe of public LinkedIn profiles supplied by Revelio Labs.

The individual-level administrative data used in this project come from the target university's admission and financial aid records in the 2011-2012 academic year and are linked using full name and date of birth to National Student Clearinghouse (NSC) data on higher education enrollment in the fall 2012 academic term. NSC data are detailed and highly accurate records on the near universe of higher education enrollment in the United States, covering over 95 percent of undergraduate student enrollment at 4 year colleges and universities in the United States. 72 percent of nonresident applicants in the sample are enrolled at a college or university in the United States in the fall term of 2012.

Voter registration records are sourced from L2 Inc., a private vendor of political and commercial data, for all American states and the District of Columbia in 2024. This data source is a close approximation to a full public registry of American citizens, covering more than 75 percent of all American citizens. Voter registration data includes citizenship and location information, and the records were linked to the target university's administrative data using students' full names and dates of birth.

Labor market outcomes come from the universe of LinkedIn profiles scraped by Revelio Labs in 2024. This dataset includes job titles and descriptions, listed skills, profile summaries, and employment locations. Revelio Labs also imputes salaries based on job titles, employers, and employment history. Recent work in labor economics has found this dataset particularly useful for tracking populations of highly-mobile workers, including international students, across jobs and locations (Amanzadeh et al., 2024; Berry et al., 2024). I link the target college's administrative records to LinkedIn profiles matching on full name and manually review duplicates for any student who matches to 15 or fewer LinkedIn profiles. In cases where there are multiple matches on full name, students are manually matched to profiles using their college enrollment record as well as age cues that can be inferred from high school graduation date, the date of college entry and exit, and the earliest date of employment. I use pre-specified definitions for labor market outcomes derived from LinkedIn data that are described in this paper's pre-analysis plan and are also summarized in Appendix A.

Appendix Table A.1 displays summary statistics for the full sample of lottery participants. Most of the nonresident applicants in the sample come from high socioeconomic status families, consistent with the characteristics we would expect given the high baseline cost of nonresident tuition fees. The mean family income reported by students is roughly 194,000 dollars per year, only 12 percent of the students were raised by a single parent, and just 20 percent are first generation college students. Other household and individual characteristics of nonresidents are similar to those of the university's in-state students, like having a household size of around 4 people, entering college at roughly 18 to 19 years old, and a narrow majority of students identifying as female. With respect to place of origin, China is the largest source of nonresident students at approximately 45 percent, with 24 percent coming from students in adjacent American states, 10 percent from students in distant American states, 8 percent from South Korea, 9 percent from other countries in Asia and Oceania, 2 percent from other countries in the Americas, and just under 1 percent from Europe or Africa.

3.2 Randomization-based Inference

Because students were assigned to three treatment arms using a random number generator in Microsoft Excel, identification of causal effects follows from a simple comparison of the outcomes across treatment arms. I validate that randomization was successful by testing for balance on pre-treatment student demographics as well as predicted outcome variables. In Tables A.2 through A.9, I test for balance on observable characteristics like ethnicity, gender, GPA, and SAT score as well as predicted outcomes, finding only 5 rejections of the null hypothesis that the treatment arms are balanced out of 66 variables at a 10 percent level. The results of these pre-specified balance tests are, therefore, consistent with a normal rejection rate given successful randomization of students across the three treatment arms.[7]

Beyond tests for balance, differential attrition is a potential threat to any RCT. Considering the risk of attrition, I note that students cannot attrit from binary decisions over whether or not to enroll in colleges and whether or not to live in the United States. The more serious attrition risk comes from students being unobservable in some types of outcome data. The research university's enrollment data, voter registration records, and National Student Clearinghouse data on college enrollment are near complete records of their respective outcomes, averting this concern. However, some measures of long-run immigration and earnings from the universe of LinkedIn profiles provided by Revelio Labs will only cover students on the platform. I note that approximately half of students eventually appear either on LinkedIn or in the United States' voter rolls and that there is no differential attrition across treatment arms.[8] In the pre-analysis plan, I specify how incomplete data are handled for each respective variable, including: deferring to complete administrative data on citizenship from voter

[7]To be conservative, I re-estimate my main findings in Appendix Table D.1, limiting to a subsample of students with family income under 250,000 dollars per year to improve balance, and include a more flexible quadratic control for income in Appendix Table D.2.

[8]46 percent of students have location data available from either LinkedIn or L2's dataset. Most missing location data occurs among students who choose to neither reside in the United States nor create a LinkedIn profile outside of the United States. There is no significant effect of tuition waiver size on appearing in the LinkedIn Data (t-statistic of -0.67) or appearing in any repository with location information (t-statistic of 0.10). To the extent that the overall rate of attrition is a concern, it should bias estimates toward zero by artificially shrinking differences in outcomes between treatment arms.

files, combining information on student location from multiple data sources, and imputing some missing outcomes like earnings using pre-specified procedures.

Turning to Hawthorne effects and John Henry effects, I note that this tuition waiver lottery was effectively a single-blind RCT. All 1,333 in-sample students knew they had been offered a tuition waiver, but they were not aware that the value of the tuition waiver had been randomly assigned or that other students had been offered nonresident tuition waivers of different values than their own. Few of the nonresident students originated from the same high school, making it unlikely that they would have been able to identify one another or communicate with one another. The fact that all students received a waiver allows the estimates in this paper to exclude behavioral responses that would appear along the extensive margin of treatment with any tuition waiver, but are constant across the intensive margin of generosity. Students' incomplete information also means that there is little risk of spillover effects between lottery participants and the stable unit treatment value assumption (SUTVA) is likely to be satisfied.

To estimate causal effects, I use the following generalized specification:

$$Y_i = \beta \cdot Waiver_i + \mathbf{X}_i' \Gamma + \varepsilon_i, \tag{5}$$

where Y_i is an outcome of interest for student i, $Waiver_i$ is the net present value (in 2012) in tens of thousands of dollars of the tuition waiver assuming an annual discount rate of 5 percent, $\mathbf{X}_i$ is a vector of pre-treatment controls including a constant term, and ε_i is an idiosyncratic error term. In this context, $\hat{\beta}$ is our estimate of the average treatment effect of 10,000 dollars of offers to waive nonresident tuition on the respective outcome of interest. I plan to vary the inclusion of covariate controls for each outcome of interest and to use linear probability models for ease of interpretability with binary outcomes.

The estimated impact of nonresident tuition is likely to be a lower bound on the treatment effects because all of the 1,333 in-sample students applied to the university at its 2012 publicly-posted sticker price of nonresident tuition. If prospective nonresident students were to see lower sticker prices in 2012, that could increase both the number of applicants and admitted nonresident students making all outcomes of interest more sensitive to tuition prices than would be observed in this RCT. In the case of estimating tuition recovery, this will mean that higher enrollment elasticity to prices should be observed, biasing the short-run estimated tuition recovery of nonresident tuition upward and the longer-run costs of nonresident tuition downward.

4 Results

4.1 Enrollment and Profit

4.1.1 Enrollment

The first set of outcomes are short-run student decisions about college enrollment in the Fall 2012 academic term, a few months after receiving tuition waiver offers. Table 1 shows the estimated impact of tuition waivers per 10,000 dollars on binary indicators for enrollment at the target university offering the waiver, enrollment at any college or university within the same state, and enrollment at any college or university within the United States. Each panel and row displays estimates for a single outcome while each column represents a different regression specification. Column 1 shows estimates without any control variables and Column 2 includes the full set of covariate controls described in Section 3.1.

Panel A shows that reducing nonresident supplemental tuition raises enrollment at the target university relative to a baseline rate of 16.2 percentage points by a substantial 3.2 percentage points per 10,000 dollars of tuition waiver offers. As Panel B illustrates, this increases the total enrollment rate of nonresident students within the state of the target university by 4.9 percentage points off a baseline of 41.7 percent.[9] Both estimates are

[9] The slightly larger point estimate for enrollment in the target state may be explained by financial aid bargaining behavior (Firoozi, 2022).

significant at a 5 percent level and are robust to including pre-treatment demographic control variables. In Panel C, I cannot reject the null hypothesis that total enrollment of nonresident students in the United States is unchanged, but the 1.6 percentage point estimate implies that roughly one half of the increase in enrollment at the target university came from students who would not otherwise choose to enroll at a college or university in the US. Results are again robust to the choice of whether or not to include pre-treatment controls.

In Appendix Table B.1, I examine how tuition waivers alter the types of institutions students attend. The results indicate that counterfactual enrollment is evenly split between three types of institutions: (i) private AAU universities, (ii) non-AAU public and private universities, and (iii) enrollment outside of the United States, each accounting for roughly one-third of the offset. This implies that the marginal student attracted by a waiver is typically weighing a diverse mix of alternative institutions with a variety of locations and qualities.

4.1.2 Profit

Following from Section 2.2, the primary benefit of nonresident tuition for a host college or university is the short-run recovery of profit[10] from nonresident students that may be used to cross-subsidize the college attendance of local students. To calculate profit, I begin by calculating total revenue. I assume that total revenue equals the net present value with a 5 percent annual discount rate of the total sticker price of tuition, less the randomly assigned tuition waiver for four years for nonresident students.[11] Profit then equals the difference between total revenue and the net present value, assuming a 5 percent annual discount rate, of instructional expenditures per capita from IPEDS for four years of instruction at the target university. Finally, I interact profit with an indicator for enrolling at the research university and use this measure as an outcome variable of interest to estimate the number

[10]This is defined as net tuition less instructional expenditures.

[11]Tuition refers specifically to the sum of mandatory charges for nonresidents plus official nonresident supplemental tuition fees, excluding other costs of attendance like housing, room and board, and books and excluding non-instructional fees for other student services.

of dollars recovered per 10,000 dollars of nonresident tuition. These procedures are likely to overestimate short-run profit.[12]

I formally estimate the impact of nonresident tuition on profit in Table 2. Panel A shows the short-run impact of offering a 10,000 dollar waiver on the actual profit generated by the target university. Offering to waive 10,000 dollars of nonresident tuition only costs the target university 835 dollars (roughly 12 percent of per student profit) due to both the low yield rate of nonresident students and the strong response of nonresident enrollment to tuition prices. As a note, this 835 dollar figure is not intended to represent the total social cost of a tuition waiver; rather, it captures the marginal fiscal cost incurred by the university and thus serves as the policy-relevant price tag for decision-makers setting waiver policy. In other words, it reflects the direct budgetary trade-offs universities face when deciding how much nonresident tuition to discount.[13]

Panel B decomposes the change in total profit into the two competing mechanisms discussed in Equation 4 and Section 2.2. Offering to waive a portion of nonresident tuition both (a) mechanically reduces profit by reducing the net tuition paid per student who yields to the target institution and (b) behaviorally raises profit by inducing a higher proportion of admitted nonresident students to yield to the target university (as long as per student profit remains positive). The respective 2,738 dollar decrease and 1,903 dollar increase in profit per 10,000 dollars of waiver offers illustrate that both the mechanical and behavioral channels are quantitatively large and economically meaningful. Although these opposing forces nearly offset and yield a relatively small net reduction of about 835 dollars in profit per 10,000 dollars of waiver offers, they demonstrate that universities face high-stakes trade-offs

[12] This method follows directly from the pre-analysis plan. There are two reasons why this method is likely to overestimate the social benefits of nonresident tuition. First, this method will overestimate tuition recovery because the tuition lottery occurred among students who were already admitted and therefore recovers a lower bound on the elasticity of enrollment to prices by missing out on the elasticity of application rates to prices. Second, it overestimates tuition recovery because it assumes students pay net tuition fees over a four year time period, rather than assuming that some number of students drop out.

[13] Having a clear estimate of this institutional cost is useful because it allows policymakers and researchers to weigh it against the opportunity cost of reallocating funds from other uses and to benchmark the returns across different forms of student aid.

when setting nonresident tuition policy.

4.1.3 Heterogeneity and Optimal Price Setting

Given that colleges set fees on nonresidents to maximize profit recovery and the reality that price discrimination on the basis of residency is a tool to achieve this objective, there is a surprising policy gap between institutions that do and do not price discriminate between domestic and international nonresident students. Although the target university does not price discriminate between these groups, I am able to estimate separate effects for American national nonresidents and foreign national nonresidents to test the impact of such a policy. In Table 3, I show the response of enrollment and profit to changes in the amount of tuition waivers offered by group.

The enrollment of American national nonresidents may be somewhat more sensitive to prices than that of foreign nationals. For example, each 10,000 dollars in tuition waiver offers raises enrollment at the target university among American national nonresidents by between a third and half of their 11.6 percentage point baseline. Foreign nonresident enrollment rises by 2.8 percentage points relative to a 18.7 percent baseline by contrast. This is consistent with the higher reported family incomes of foreign national nonresidents as well as the reality that American nationals are likely to have more admission offers to choose amongst within the United States. This matters, again, because the effect of tuition waivers on profits hinges on the competing mechanisms of lower profit per student and the sensitivity of the yield rate to enrollment. Since American nationals are more price-sensitive, an institution would expect to lose less profit when offering them comparable waivers following from Section 2.2. That intuition aligns with the results for the NPV of profit for each group in Panels A and B.

The amount of profit lost per 10,000 dollars of waiver offers is 1,161 dollars for foreign nationals. The significant negative estimate implies the level of nonresident tuition that maximizes profit is above the range tested in the waiver experiment. In other words, the policy of generally not offering any financial aid to this group is consistent with a university whose objective is to profit maximize using nonresident tuition. However, the corresponding result for profit is effectively null for out-of-state American national nonresidents in Panel B, meaning that the profit maximizing level of nonresident tuition for the group is within the range of offered waivers and below the sticker price of nonresident tuition the target university sets for American national nonresidents.

On balance, the results are consistent with the target university having the uniform nonresident tuition price set at a level that comes close to maximizing its short-run profit from the group as a whole. From the perspective of a profit-maximizing university, however, the policy of setting the same price for American nationals and foreign nationals seems less defensible given their distinct demand curves. Because the enrollment of American nationals is more price sensitive to tuition waivers, another layer of price discrimination that raised sticker prices for foreign national nonresidents and reduced them for American national nonresidents could plausibly recover greater total profit.

4.2 Migration, Inframarginal Students, and the Social Planner

While the primary interests of a public college or university hosting nonresident students may be the short-run recovery of profits, a social planner would look at a longer time horizon. As Section 2.2 illustrates, the migration response of nonresident students to tuition has the potential to generate large effects on labor markets and tax revenue at both the local and national level. In particular, it is worth noting that the migration rate per dollar of tuition that the university offers to waive can be as large or even larger than the enrollment effect per dollar. This is because inframarginal students, who choose to enroll regardless of the tuition levels they are assessed, may be more likely to remain in the state or country conditional on enrollment as a result of lower tuition.

4.2.1 Migration Evidence from Voter Files

In Table 4, I estimate the effects of nonresident tuition on appearing on the voter rolls of both the target state and the United States. Each panel includes results for a different outcome variable and the two columns show results for specifications with and without covariate controls. Column 1 of Panel A implies that every 10,000 dollars in tuition waiver offers raises the odds a student will be observed on the voter rolls of the target state by 3.3 percentage points roughly 12 years after initial college application, a rate that is almost identical to the increase in enrollment at the target university and two thirds as large as the increase in total enrollment at any college or university in the target state. The magnitude of this effect is also notable because it is roughly half the size of the baseline share of students who would ultimately live in the target state and appear on the state's voter rolls.

The effect of tuition waivers on appearing in the target state's voter rolls is driven entirely by students who were already citizens or permanent residents at the time of college application (See Tables C.8 and C.9). Foreign nationals are simply harder to observe in voter roll data given that they have exceedingly low odds of naturalization within 12 years of college application, which artificially biases estimates for foreign national students toward zero.[14] My findings for appearing in the target state's voter rolls remains significant at the 1 percent level even when conditioning the outcome on being observed anywhere in the United States' voter rolls.[15]

In Panel B, I find a positive but statistically insignificant effect on appearing on the voter rolls anywhere in the United States: a 2.1 percentage point rise per 10,000 dollars of waiver offers, which closely mirrors the 1.6 percentage point increase in college and university enrollment in the U.S. This again suggests that approximately one-third of counterfactual longer-run residence would have occurred outside the United States.

[14]For comparison, enrollment outcomes were only somewhat larger for US citizens and permanent residents, but not to the degree that is observed for the longer-run relocation. For example, the point estimates are 3.8 percentage points compared to 2.8 percentage points for target university enrollment, which is not a significant difference at a 10 percent level, but may be economically meaningful.

[15]This implies the results are not explained by increases in overall registration rates.

4.2.2 Migration Evidence from LinkedIn

I use the subsample of students with LinkedIn profiles and data for the next set of migration outcomes. Specifically, I estimate the impact of tuition waivers on a binary indicator for executive leadership skills and residence in the target state in 2024, a binary indicator for entrepreneurial skills and residence in the target state in 2024, and a binary indicator for innovation skills and residence in the target state in 2024. Each of the three outcomes was selected based on the high-demand skills held by college graduates described in Martellini et al. (2024) and are defined in Appendix A. Table 5 shows results for each outcome across rows and different specifications in each column, following the pattern of previous tables. Samples sizes in the first three rows are smaller than the full sample because the data come from the universe of LinkedIn profiles scraped by Revelio Labs and are set to missing for students who do not create a profile on the social media platform. Conditional on appearing in LinkedIn, the fraction of students with executive, entrepeneurial, and innovative skills are 73, 12, and 78 percent respectively.[16]

Table 5 shows the estimated impact of nonresident tuition waivers per 10,000 dollars on each of the three indicators for a student having one of the high-demand skills *and* residing in the state where they were offered a tuition waiver. Columns once again reflect different specifications that vary the inclusion of controls. Beginning with Row 1, I find that every 10,000 dollars in tuition waiver offers increases the share of nonresidents who hold executive skills in the target state in 2024 by 5.9 percentage points, which is more than half the baseline rate. Turning to Row 2, there is an insignificant 0.9 percentage point increase in the estimated migration of students with entrepeneurial skills to the target state. Finally, Row 3 shows another larger increase in the share of nonresident students who eventually hold innovative skills in the target state at a rate of 5.2 percentage points per 10,000 dollars, which is again just under half the baseline rate. Offering tuition waivers also appears to

[16]Tuition waivers have no estimated impact on the probability that a student creates a LinkedIn profile and there is no association between measures of academic performance and the probability of creating a LinkedIn profile.

significantly increase observed earnings within the target state, a finding that is discussed in greater detail in Section 4.2.4. In every case, results are robust to the inclusion of controls for pre-treatment student demographics.

With respect to the final set of long-run outcomes, I estimate the impact of tuition waivers on a binary indicator for entrepreneurial skills and residence in the United States, a binary indicator for innovation skills and residence in the United States, a binary indicator for executive leadership skills and residence in the United States, and estimated earnings in the United States. Table 6 displays results for each outcome using the outcome variables, methods, and specifications that mirror those in Table 5, but for the United States as a whole. In Panel A, I find insignificant impacts of nonresident tuition waivers on the number of executives, entrepeneurs, and innovators who eventually reside within the United States. Panel B shows positive but insignificant increases in earnings within the United States that are smaller than the corresponding estimates for earnings in the target state, implying that labor market benefits to one part of the US do not come exclusively at the expense of others.

To extend and cross-validate my migration findings from voter roll records, I estimate migration effects that incorporate employment location data from LinkedIn and display these results in Table 7.[17] The first panel limits estimates to the subsample of students for whom I observe LinkedIn employment records, whereas the second panel uses the full sample and adds on voter roll records for students who do not appear on the LinkedIn platform. Results from LinkedIn employment data confirm my findings from voter roll records, showing that offering tuition waivers seems to substantially increase long-run migration to the target state relative to the baseline while having small, if any, impact on eventual relocation to the United States as a whole. Appendix Tables C.10 and C.11 illustrate that these migration effects are driven almost entirely by out-of-state American national nonresidents rather than foreign national nonresidents.

[17]Waivers have no significant impact on being observed in the outcome data in Appendix Table D.4.

4.2.3 Inframarginal Students

The treatment effects of tuition waivers on migration appear much larger than what would be expected from evidence on the transition rates of nonresident students in Beine et al. (2023). This is because students' migration decisions are not simply a fixed proportion of those who enroll at postsecondary institutions either in the target state or the United States as a whole. Inframarginal students, defined as students who enroll regardless of the net tuition level randomly assigned to them through the waiver experiment, may become more likely to eventually migrate conditional on enrollment as a result of the waiver policy. Indeed, the magnitude of the treatment effects I find for longer-run migration sometimes exceeds the treatment effects on target university enrollment, implying that waivers work by raising the rate of longer-run relocation conditional on enrollment rather than through higher enrollment alone (See Appendix Table B.2).

There are several reasons why inframarginal students migration decisions may change. First, reduced debt burdens may allow students to prioritize majors or amenities unique to the target state rather than nationally competitive wages (Luo and Mongey, 2019; Jacob et al., 2023), making them more likely to accept in-state job offers.[18] Second, lower levels of debt may make students more willing to take on economic risks (Krishnan and Wang, 2019; Morazzoni, 2021) like remaining in the target state, rather than returning to their place of residence (Di Maggio et al., 2019). Third, greater short-run financial aid may enable students to avoid work-for-pay jobs in favor of unpaid internships and extracurricular activities (DesJardins et al., 2010; Anderson and Zaber, 2024) which could improve human capital and employment prospects in the state's labor market (Kessler et al., 2019). Fourth, improved credit access stemming from lower debt may make it easier to finance housing (Mezza et al., 2020; Bleemer et al., 2021; Mezza et al., 2024) and remain in-state. Finally, a larger waiver itself may generate goodwill or foster an increased attachment to the state,

[18] Existing evidence also shows that indebted students prioritize high salaries over public service jobs that have higher amenity value (Field, 2009; Rothstein and Rouse, 2011).

altering preferences in ways that increase local retention.

I formally document a role of inframarginal students in generating migration effects by regressing longer-run residence in the target state on the size of the tuition waiver among the subsample of students who enrolled at universities in the target state. The estimated relationship is positive and significant at the 1 percent level: larger waivers are associated with much higher odds that a student who enrolled in the target state appears on the state's voter rolls in subsequent years (see Appendix Table B.3). This higher "transition rate" from in-state college enrollment to long-run target state residence likely reflects several channels through which lower tuition reshapes career paths among inframarginal students who would have enrolled in-state regardless of price.

While the main results assume linear treatment effects across waiver amounts, disaggregating by treatment arm reveals meaningful nonlinearity. Table 8 reports heterogeneous treatment effects by waiver size for enrollment and migration; the underlying regression results and additional outcomes appear in Appendix B. In Panel A, enrollment at the target university and other in-state institutions reflects a convex demand curve: moving from a 30,000 dollar to a 40,000 dollar waiver generates larger per-dollar effects on in-state enrollment than moving from 20,000 to 30,000 dollars. In contrast, enrollment at any college or university in the United States is most responsive between the 20,000 and 30,000 dollar treatment arms, with negligible or even slightly negative marginal effects from increasing the waiver from 30,000 to 40,000 dollars.

Panel B of Table 8 helps illustrate the distinction between marginal and inframarginal students. The large increase in US college enrollment between the 20,000 and 30,000 dollar treatment arms indicates that this range primarily captures students on the extensive margin of attending college in the United States at all, who I refer to as marginal students. By contrast, the additional discount from 30,000 to 40,000 dollars generates relatively little new U.S. enrollment. At the same time, long-run migration to the target state increases substantially from the 20,000 to the 30,000 dollar arm and exhibits diminishing or flat marginal returns from 30,000 to 40,000 dollars. Together, these arm-specific patterns for migration to the target state cannot be reconciled with a story in which long-run migration arise only from marginally enrolled students, and instead point to important inframarginal responses among students who would have enrolled regardless of tuition levels but change their post-graduation location choices.

The inframarginal students who are persuaded to remain in the target state overwhelmingly appear to do so between the 20,000 and 30,000 dollar treatment arms, which aligns with the largest positive effects of nonresident tuition waivers on migration, earnings, and externalities on the skill composition of the local labor market. I take this to imply that willingness to pay varies meaningfully across nonresident student populations, with the highest-skill students concentrated among those with relatively high willingness to pay and on the margin of retention in the target state. Such nonlinearity in treatment effects also suggests the existence of an optimal nonresident tuition level that maximizes long-run public benefits while minimizing short-run institutional costs.

4.2.4 Earnings and Heterogeneity

Table 9 displays earnings and related outcomes[19] in the target state and United States, using estimated salaries based on job titles and employment history from Revelio Labs.[20] I find that every 10,000 dollars of tuition waiver offers increases the present value of earnings

[19]Per the PAP, NPV of earnings is defined as "the imputed earnings based on work history and job title from Revelio Labs' individual dataset. In cases where [this] is absent, I will link job titles to the most similar BLS occupation code and its annual mean wages. These data will come from Revelio Labs and manually collected records. I will assume students work for another 20 years at a constant level of earnings in their recorded place of residence beginning 8 years after college application to be conservative. Earnings will be imputed for people without LinkedIn job titles by assuming an annual mean earnings level equal to the sample average estimated mean annual wage for students whose occupational titles I observe."

[20]Consistent with the PAP, I impute salaries for students who do not have an earnings record from Revelio Labs but are observed to be in a relevant location – the target state for target state earnings and the US for US earnings – by assigning them the mean value of earnings from the sample for whom I do observe earnings. More conservative approaches, like reducing estimated earnings across the board for all students by 25 percent, also lead to the same conclusion as my main estimates (See Table D.3). For robustness, I rerun estimated earnings and tax revenue effects using the subsample of 397 students who appeared on LinkedIn to avoid the need for imputed values entirely, and I find much larger effects on earnings than the pre-specified results from Panel A of Table 9 in Appendix Table D.5.

in the target state by 34,151 dollars, reflecting both the response of labor market mobility to nonresident tuition and the high earnings levels of students who are admitted to selective universities. These results remain significant, if somewhat smaller, at 25,302 dollars of earnings per 10,000 dollars of nonresident tuition when including pre-treatment control variables in the specification. In the United States, as a whole, the corresponding estimates are noisier and smaller at 14,643 dollars and 9,016 dollars across the two specifications. Together with the implied state and federal tax revenue effects in Panel A, these estimates indicate that the present value of fiscal gains substantially exceeds the university's forgone profit and a social planner would likely prefer a lower average nonresident tuition level than the status quo.

One potential mechanism linking tuition waivers to long-run earnings is degree completion. While the original pre-analysis plan included graduation outcomes, I was unable to observe graduation for students who did not enroll at the target university due to data constraints. Among the subset of students who did enroll at the target campus, I find that tuition waivers have no significant association with graduation and the point estimate is negative. This suggests that improved degree completion at the target university is unlikely to be the primary mechanism driving the observed earnings effects. However, I cannot rule out other unobserved academic adjustments, such as major choice or graduate school attendance, as possible channels linking tuition waivers to long-run labor market outcomes.

Heterogeneity between out-of-state American nationals and foreign nonresidents is somewhat noisy, but Panels B and C of Table 9 reveal economically large differences when I classify students as American nationals if they have U.S. citizenship or legal permanent residence at application.[21] Because migration of out-of-state American nationals is more price sensitive than that of foreign students (Tables C.10 and C.11), each 10,000 dollar waiver raises earnings in the target state by 73,821 dollars for U.S. nationals, compared with a noisy 11,679 dollars for foreign nonresidents. Effects on total earnings in the US are smaller

[21] This definition was not in the original PAP but was modified in response to referee and editor comments.

and more similar across the two groups. For American nationals, the implied state and federal tax revenue in Panel C significantly exceeds the null effect on university profit, so both state and federal social planners would prefer lower nonresident tuition than the university, and even a profit-maximizing university would choose a lower tuition level for this group than the status quo. By contrast, for foreign nonresidents the present value of state tax revenue in Panel B does not offset the university's forgone profit, and even at the federal level the point estimates are at roughly break-even and imprecisely estimated. If we take the point estimates at face value, for international students both a profit-maximizing university and a state-level social planner would favor higher tuition than the levels within range of the waiver experiment, while a federal social planner would prefer tuition below the status quo. On balance, these findings demonstrate that price discrimination between nonresident students by nationality could likely raise both university profits and social welfare relative to a uniform nonresident tuition policy.

Consistent with the pre-analysis plan, I also test for heterogeneity by home address in Panels A through C and by intention to major in STEM disciplines in Panels D and E of Table 10 (See also Appendix C). Similar to the general pattern of results by nationality, results by place of home address suggest that a social planner that values both tax revenue and forgone university profits would prefer lower fee levels than a profit maximizing university for all groups. Among students who reside in China and who reside abroad, the value of nonresident tuition that the results imply would maximize social welfare for the state falls above the range tested in the experiment, whereas the optimal tuition level for a federal social planner is implied to be lower than the status quo. For both a profit-maximizing university and a social planner operating at any level, nonresident tuition rates among students who live in the United States are set too high in the status quo. Once again, the sharp heterogeneity by place of origin would appear to justify introducing another degree of price discrimination between nonresident students based on place of origin.

Turning to Panels D and E, the estimated effects are much larger for intended STEM majors than for non-STEM majors. For STEM students, the present value of state and federal tax revenue generated by an additional 10,000 dollars of tuition waiver offers substantially exceeds the university's forgone profit, implying that the welfare-maximizing tuition level for this group lies well below the status quo. Among non-STEM majors, the effects are closer to break-even at the state level and only modestly positive, and imprecise, at the federal level if we take a literal interpretation of the point estimates. For a social planner, these results still imply that the welfare-maximizing tuition price for non-STEM students lies below the current level but is still higher than that for STEM majors. On balance, my findings are consistent with both the higher earnings of STEM graduates and the possibility that lower costs of attendance are complementary to work-authorization programs such as OPT, which reduce frictions to migrating and entering the labor market after graduation.

5 Discussion

5.1 The Social Planner's Problem

The results of this experiment highlight a wedge between the objective of a university that uses nonresident tuition to profit-maximize and that of a social planner who values both institutional finances and long-run fiscal externalities. From the university's perspective, the key object is short-run profit recovery from nonresident tuition. Offering to waive 10,000 dollars of nonresident supplemental tuition reduces profit by only 835 dollars on average, reflecting the low yield rate of nonresidents and the strong enrollment response to prices. By contrast, a social planner cares about both this foregone profit and the downstream effects of tuition on earnings, tax revenue, and the skill composition of the labor market. Table 9 shows that each 10,000 dollars of tuition waiver offers raises the present value of earnings in the target state by roughly 25,000 dollars, and implied state and federal tax revenue by several thousand dollars, far in excess of the university's forgone profit. Taken literally, these estimates suggest that a social planner maximizing aggregate welfare or surplus would prefer substantially lower nonresident tuition than the status quo, even before accounting for any additional externalities from retaining executives and innovators.

A central reason the social planner's preferred tuition schedule differs from the university's is the role of inframarginal students. The migration evidence from voter files and LinkedIn indicates that the migration response per dollar of tuition waiver offers can be as large as, or larger than, the enrollment response. Moreover, treatment-arm heterogeneity shows that moving from a 20,000 to a 30,000 dollar waiver has sizeable effects on both US enrollment and long-run residence in the target state, whereas increasing the waiver further to 40,000 dollars generates relatively little additional US enrollment but still raises in-state enrollment and residence. Within the subsample of students who enroll in the target state, larger waivers significantly increase the probability of remaining there after graduation. These patterns are hard to reconcile with a model in which long-run migration effects operate only through newly enrolled (marginal) students. Instead, they point to substantial inframarginal responses: students who would have enrolled regardless of price, but whose career and location choices, and thus tax contributions and spillovers, shift in response to lower tuition.

Heterogeneity by nationality adds another complication in the tension between institutional and social objectives and illustrates the potential gains from an additional layer of price discrimination. For out-of-state American nationals, tuition waivers strongly affect both enrollment and long-run residence. Every 10,000 dollars of waiver offers raises earnings in the target state by over 70,000 dollars, and the implied state and federal tax revenue significantly exceeds the essentially null effect on university profit. In other words, for this group, the university is essentially locally flat in profit with respect to nonresident tuition, while the social planner's objective is sharply increasing in tuition waiver size. Both state and federal social planners would therefore prefer substantially lower nonresident tuition for American nationals than the university currently charges, and even a profit-maximizing university would set tuition for this group below the status quo.

By contrast, for foreign nonresident students the estimated profit loss per 10,000 dollar waiver is meaningful and statistically significant, while the earnings and tax effects are smaller and more imprecisely estimated. The point estimates suggest that, at least from the state's perspective, the profit-maximizing tuition level for foreign nationals lies above the range of waivers tested and that state tax revenue alone is insufficient to offset the university's forgone profit. A federal social planner, who internalizes federal tax revenue and university profit, may be closer to indifference over tuition levels within the experimental range, but the estimates are noisy. Taken together, these results imply that a uniform nonresident tuition schedule anchored on foreign demand is misaligned with the social planner's objective: optimal policy would feature lower tuition for out-of-state American nationals and similar or possibly lower tuition levels for foreign nonresidents, relative to the current price that they are both assessed.

Additional heterogeneity by home location and intended major reinforces this conclusion. Students residing in the United States, and especially those intending to major in STEM fields, generate large earnings and tax revenue gains per dollar of tuition waiver offers that exceed the university's marginal forgone profit. For these groups, the welfare-maximizing tuition level lies below the status quo, and below what would be optimal for lower-earning or less price-sensitive groups. In contrast, for some foreign-origin groups the implied state-level welfare-maximizing tuition lies above the experimental range (around the status quo), even though a federal social planner may still find lower tuition attractive when accounting for national tax revenue. These patterns suggest that, from a social-planning perspective, a richer pricing scheme for nonresident tuition – discriminating not only by target-state residency but also by nationality, place of origin, and field of study – could substantially increase social surplus.

The evidence points, on balance, to a meaningful wedge between the tuition policy that maximizes short-run university profit and the policy that maximizes long-run public benefits. Inframarginal students play a central role in creating this wedge: their migration, earnings, and labor market choices respond strongly to tuition, even when enrollment does not. Because the migration and earnings responses are especially pronounced for out-of-state American nationals and prospective STEM majors, an additional layer of price discrimination that lowers tuition for these groups and, if necessary, raises it for foreign nonresidents would likely improve both university finances and social welfare relative to the status quo policy with uniform nonresident tuition.

5.2 Crowd-Out and Spillovers

As a caveat, this framework compares institutional tuition revenue against longer-run state earnings and fiscal spillovers. It does not account for potential general equilibrium effects on in-state students. If attracting additional nonresident students strains instructional capacity or displaces local students, this could dampen the estimated gains. For instance, reduced enrollment opportunities for in-state students might lower their degree attainment or long-run taxable earnings, partially offsetting the fiscal benefits of retaining high-skilled nonresidents. Alternatively, expanding total enrollment to accommodate nonresident students could introduce negative cohort effects, as discussed in Bound and Turner (2007). I cannot directly test these spillovers given the design of the original lottery, which was implemented conditional on admission. Nonetheless, I acknowledge that any comprehensive welfare analysis should weigh not only the gains from marginal nonresident students, but also the possible downstream costs or benefits for local students. The estimates presented here should therefore be interpreted as partial equilibrium effects that hold local enrollment fixed.

To better quantify the risk of disemployment of local workers without arbitrarily selecting a labor demand elasticity, I calculate how high the crowd-out rate would need to be for the sum of the impact on short-run university profit and longer-run tax revenue to be zero. In effect, this is a rudimentary test of social welfare that tells us what the rate of crowd-out of local resident earnings would have to be for the university's net present value of foregone tuition to be exactly equal to the net present value of additional tax revenue the state or federal government recoups in the future, less the lost revenue from displaced domestic workers.

There are three reasons why this is a conservative approach. First, I am not summing the additional tax revenue collected by the federal and state governments together. Instead, I am considering each separately despite the fact that both entities have their own revenue and a social planner would weigh both. Second, I am effectively assuming that American nonresidents from other states are displacing locals even when they get a job in their state of residence when I calculate these crowd-out rates at the national level. Third, I am assuming that there are no positive effects on innovation in the local labor market and that there are no other positive externalities or complementarities of immigration for local workers.

Calculation of the crowd-out rate that leads to zero effect for aggregate social welfare is straightforward. I use estimates from Table 9 to divide the impact on university profit by the tax revenue recouped by the respective level of government (either state or federal) and then subtract the number one from this fraction.

I calculate that the crowd-out rate would have to be between -0.51 and -0.44 at the state-level. In other words, each dollar of nonresident earnings would have to crowd out 44 to 51 cents of local earnings for nonresident tuition to have null effects on social welfare within the target state. At the national-level, each dollar of new nonresident earnings would have to crowd out between 68 and 77 cents of local earnings for a null effect of nonresident tuition on this rudimentary measure of social welfare.

6 Conclusion

This paper uses a computer-randomized tuition waiver lottery to study how nonresident tuition affects college enrollment, migration, and labor market outcomes over more than a decade. Drawing on a pre-analysis plan and administrative data on 1,333 admitted non-resident students, I document the trade-offs between short-run tuition revenue for a public research university and the longer-run fiscal and labor market consequences for the state and country in which it is located.

In the short run, reducing nonresident supplemental tuition substantially increases enrollment at the target university and within the state, indicating the high price sensitivity of nonresident enrollment. The counterfactual enrollment patterns reveal that roughly half of the marginal students attracted by tuition waivers would otherwise have enrolled outside the United States, underlining the importance of tuition policy for both domestic and international flows of human capital. At the same time, the net cost of offering tuition waivers to the university is modest: each 10,000 dollar waiver reduces short-run profit by only about 835 dollars, once higher yield rates are taken into account.

The longer-run effects are much larger. Tuition waivers meaningfully increase the probability that nonresident students appear on the target state's voter rolls and LinkedIn employment records many years after application, and they raise the frequency of executive and innovation skills and the present value of earnings in the target state by several tens of thousands of dollars per 10,000 dollars of waived tuition. These impacts are driven not only by marginal students whose enrollment decisions are shifted by the lottery but also by inframarginal students who would have enrolled regardless of price and whose career and location choices respond strongly to lower tuition. Treatment-arm heterogeneity and transition-rate estimates show that larger waivers raise the probability of remaining in the state conditional on enrollment, implying that tuition policy shapes the retention of already-enrolled high-skill students rather than simply expanding enrollment.

The earnings estimates, combined with plausible state and federal tax rates, indicate that the present value of additional tax revenue generated by tuition waivers substantially exceeds the university's forgone profit. From the perspective of a social planner who values both institutional finances and fiscal externalities, the current level of nonresident tuition at the target university appears to be set above the level that maximizes aggregate surplus. Inframarginal students play a central role in creating this wedge: their migration and earnings responses to tuition changes are large, yet their effect on university profit is limited.

Heterogeneity analyses sharpen these conclusions and highlight the potential gains from a richer price scheme of nonresident tuition. The effects of tuition waivers on in-state earnings and tax revenue are especially large for out-of-state American nationals and for students intending to major in STEM fields. For these groups, an additional 10,000 dollars of tuition relief generates increases in the net present value of earnings and implied tax revenue that are much larger in magnitude than the university's marginal loss in profit, suggesting that the welfare-maximizing tuition level lies well below the status quo. By contrast, foreign nonresident students and some foreign-origin subgroups appear less responsive on the migration and earnings margins and more costly in terms of forgone profit, making higher tuition levels more defensible for them from both a state-level and institutional perspective. These patterns imply that price discrimination across nonresident students, by nationality, place of origin, and field of study, could increase both university profit and social welfare relative to the common practice of a uniform nonresident tuition policy.

Importantly, the tuition waiver lottery operates conditional on admission, so the estimates speak to the pricing margin rather than to the consequences of expanding or contracting nonresident enrollment slots. Admission standards and local student access are held fixed, and the estimated effects should therefore be interpreted as partial equilibrium responses that isolate one key component of a broader general equilibrium problem. Within this partial equilibrium frame, however, the evidence suggests that aligning university pricing strategies more closely with state and federal migration and fiscal objectives, by lowering tuition for high-earning, price-sensitive groups such as out-of-state American nationals and prospective STEM majors, could make nonresident tuition a more effective tool for attracting *and retaining* skilled workers, with minimal costs to university profit.

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Tables

Table 1: Enrollment Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Enrollment at Target University		
	[Baseline: 0.1622]	
Target University	0.0315**	0.0345***
	(0.0148)	(0.0129)
p-value	[0.0337]	[0.0076]
q-value	[0.0506]	[0.0187]
B. Enrollment Anywhere in the Target State		
	[Baseline: 0.4167]	
Any Target State College	0.0489***	0.0523***
	(0.0188)	(0.0189)
p-value	[0.0093]	[0.0057]
q-value	[0.0187]	[0.0187]
C. Enrollment Anywhere in the United States		
	[Baseline: 0.6779]	
Any US College	0.0156	0.0110
	(0.0175)	(0.0173)
p-value	[0.3724]	[0.5257]
q-value	[0.4468]	[0.5257]
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. P-values are shown for each estimate in brackets in the row title "p-values". Adjusted q-values from the Simes procedure to correct for multiple hypothesis testing are for each estimate in brackets in the row titled "q-values". "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table 2: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. NPV of Profit for Target University		
	[Baseline: $6,926]	
NPV of Profit	-835*	-714
	(504)	(438)
B. NPV of Profit Decomposed by Mechanisms		
From Higher Enrollment	1903**	2084***
	(896)	(779)
From Lower Net Price	-2738***	-2798***
	(429)	(386)
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Profit refers to the difference between net tuition paid by the student and estimated instructional expenditures. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.

Table 3: Effects of Tuition Waivers on per 10,000 Dollars by Nationality

Outcome	(1)	(2)
A. Foreign National Nonresidents (N=845)		
	[Baseline:	*0.1867]*
Target University	0.0283	0.0228
	(0.0192)	(0.0168)
	[Baseline:	*0.4567]*
Any Target State College	0.0333	0.0363
	(0.0235)	(0.0242)
	[Baseline:	*0.5709]*
Any US College	0.0180	0.0159
	(0.0232)	(0.0241)
	[Baseline:	*$7,980]*
NPV of Profit	-1161*	-1336**
	(657)	(581)
B. American National Nonresidents (N=488)		
	[Baseline:	*0.1161]*
Target University	0.0383*	0.0600***
	(0.0227)	(0.0206)
	[Baseline:	*0.3419]*
Any Target State College	0.0786**	0.0806**
	(0.0311)	(0.0336)
	[Baseline:	*0.8774]*
Any US College	0.0084	-0.0039
	(0.0204)	(0.0223)
	[Baseline:	*$4,860]*
NPV of Profit	-205	502
	(758)	(669)
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "American Nonresidents" refers to the subsample of students who were American nationals, either citizens or permanent residents, but were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table 4: Migration Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Registered in Target State after 12 Years		
	[Baseline: 0.0608]	
Registered in Target State	0.0329***	0.0268**
	(0.0108)	(0.0105)
p-value	[0.0023]	[0.0109]
q-value	[0.0093]	[0.0218]
B. Registered in the United States after 12 Years		
	[Baseline: 0.2005]	
Registered in United States	0.0213	0.0121
	(0.0157)	(0.0122)
p-value	[0.1745]	[0.3235]
q-value	[0.2327]	[0.3235]
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. P-values are shown for each estimate in brackets in the row title “p-values”. Adjusted q-values from the Simes procedure to correct for multiple hypothesis testing are for each estimate in brackets in the row titled “q-values”. Registration refers to appearing in the voter registration rolls of the corresponding location, which requires American citizenship and covers roughly three quarters of all American citizens. “Baseline” refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table 5: Labor Mobility Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Labor Supply in Target State 12 Years Later (N=397)		
	[Baseline:	*0.0909]*
Executives in Target State	0.0591**	0.0688***
	(0.0236)	(0.0237)
p-value	[0.0127]	[0.0040]
q-value	[0.0339]	[0.0161]
	[Baseline:	*0.0070]*
Entrepeneurs in Target State	0.0089	0.0071
	(0.0082)	(0.0075)
p-value	[0.2788]	[0.3440]
q-value	[0.3187]	[0.3440]
	[Baseline:	*0.1119]*
Innovators in Target State	0.0517**	0.0564**
	(0.0246)	(0.0247)
p-value	[0.0367]	[0.0230]
q-value	[0.0534]	[0.0460]
B. NPV of Earnings in the Target State (N=1,333)		
	[Baseline:	*$80,218]*
Salary in Target State	34151***	25302**
	(11718)	(12314)
p-value	[0.0036]	[0.0401]
q-value	[0.0161]	[0.0534]
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. P-values are shown for each estimate in brackets in the row title "p-values". Adjusted q-values from the Simes procedure to correct for multiple hypothesis testing are for each estimate in brackets in the row titled "q-values". Excutives refers to an indicator for both residing in-state and being flagged as having executive leadership skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Entrepeneurs refers to an indicator for both residing in-state and being flagged as having entrepeneurial skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Innovators refers to an indicator for both residing in-state and being flagged as having research or innovation skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Salary refers refers to an indicator for residing in-state interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table 6: Labor Mobility Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Labor Supply in the US 12 Years Later (N=397)		
	[Baseline: 0.4755]	
Executives in United States	-0.0494	-0.0474
	(0.0335)	(0.0326)
p-value	[0.1414]	[0.1476]
q-value	[0.5904]	[0.5904]
	[Baseline: 0.0629]	
Entrepeneurs in United States	0.0023	-0.0012
	(0.0168)	(0.0169)
p-value	[0.8905]	[0.9455]
q-value	[0.9455]	[0.9455]
	[Baseline: 0.4825]	
Innovators in United States	-0.0067	-0.0066
	(0.0339)	(0.0327)
p-value	[0.8433]	[0.8407]
q-value	[0.9455]	[0.9455]
B. NPV of Earnings in the United States (N=1,333)		
	[Baseline: $167,787]	
Salary in United States	14643	9016
	(13940)	(11909)
p-value	[0.2936]	[0.4491]
q-value	[0.7831]	[0.8982]
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. P-values are shown for each estimate in brackets in the row title "p-values". Adjusted q-values from the Simes procedure to correct for multiple hypothesis testing are for each estimate in brackets in the row titled "q-values". Excutives refers to an indicator for both residing in the United States and being flagged as having executive leadership skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Entrepeneurs refers to an indicator for both residing in the United States and being flagged as having entrepeneurial skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Innovators refers to an indicator for both residing in the United States and being flagged as having research or innovation skills given pre-specified definitions based on their employment history and profiles on LinkedIn. Salary refers refers to an indicator for residing in the United States interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table 7: Effects of Tuition Waivers on per 10,000 Dollars

Outcome	(1)	(2)
A. Employed by Location in 2024 (N=397)		
	[Baseline:	*0.1538]*
In Target State, 2024	0.0490*	0.0528*
	(0.0269)	(0.0275)
	[Baseline:	*0.5804]*
In America, 2024	0.0050	0.0141
	(0.0335)	(0.0322)
B. Location of Residence in 2024 (N=1,333)		
	[Baseline:	*0.0968]*
In Target State, 2024	0.0341***	0.0254**
	(0.0126)	(0.0124)
	[Baseline:	*0.3221]*
In America, 2024	0.0085	-0.0005
	(0.0178)	(0.0152)
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000). Panel A is restricted to the subsample of individuals who appear in the LinkedIn employment data. Panel B includes the full sample of all students. "Located In-State" refers to being recorded in the target state in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles. "Located in America" refers to being recorded in the United States in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles.

Table 8: Enrollment and Migration Effects of Nonresident Tuition Waivers by Arm

	(1)	(2)	(3)	(4)	(5)	(6)
	Target U		Target State		USA	
A. Enrollment Choices in 2012						
30,000 Dollars	0.0180	0.0289	0.0315	0.0429	0.0563*	0.0457
	(0.0253)	(0.0216)	(0.0333)	(0.0324)	(0.0306)	(0.0299)
40,000 Dollars	0.0558**	0.0611***	0.0867***	0.0927***	0.0277	0.0198
	(0.0263)	(0.0229)	(0.0333)	(0.0335)	(0.0310)	(0.0307)
B. Migration Outcomes in 2024						
30,000 Dollars			0.0450**	0.0317*	0.0653**	0.0384*
			(0.0185)	(0.0182)	(0.0283)	(0.0218)
40,000 Dollars			0.0583***	0.0477**	0.0378	0.0216
			(0.0191)	(0.0187)	(0.0278)	(0.0217)
Controls	No	Yes	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Enrollment choices refer to the colleges or universities at which students were observed to have enrolled in the Fall 2012 acdemic term from National Student Clearinghouse data. Migration outcomes refer to where students were observed to reside in 2024. All treatment effects are estimated relative to the omitted group that was offered 20,000 dollars in nonresident tuition waivers.

Table 9: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Present Value for Full Sample (N=1,333)		
NPV of Profit	-835*	-714
	(504)	(438)
Salary in Target State	34151***	25302**
	(11718)	(12314)
Target State Tax Revenue	1708***	1265**
	(586)	(616)
Salary in United States	14643	9016
	(13940)	(11909)
United States Tax Revenue	3661	2254
	(3485)	(2977)
B. Present Value for Foreign Nationals (N=845)		
NPV of Profit	-1161*	-1336**
	(657)	(581)
Salary in Target State	11679	12078
	(11163)	(12520)
Target State Tax Revenue	584	604
	(558)	(626)
Salary in United States	5622	9244
	(5739)	(6579)
United States Tax Revenue	1406	2311
	(1435)	(1645)
C. Present Value for US Nationals (N=488)		
NPV of Profit	-205	502
	(758)	(669)
Salary in Target State	73821***	52546*
	(24485)	(29022)
Target State Tax Revenue	3691***	2627*
	(1224)	(1451)
Salary in United States	26451	7140
	(29360)	(34185)
United States Tax Revenue	6613	1785
	(7340)	(8546)
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Profit refers to the difference between net tuition paid by the student and estimated instrucitonal expenditures. Salary refers refers to an indicator for location interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.

Table 10: Heterogeneous Treatment Effects of Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. NPV, Students Residing in China (N=607)		
NPV of Profit	-1724**	-1996***
	(811)	(726)
Target State Tax Revenue	1208	1547*
	(792)	(872)
United States Tax Revenue	3991	7242**
	(2725)	(3127)
B. NPV, Students Residing Abroad (N=878)		
NPV of Profit	-1212*	-1222**
	(653)	(564)
Target State Tax Revenue	877	742
	(652)	(698)
United States Tax Revenue	3456	5061**
	(2296)	(2455)
C. NPV, Students Residing in the US (N=455)		
NPV of Profit	7	346
	(748)	(735)
Target State Tax Revenue	3160***	1804
	(1144)	(1348)
United States Tax Revenue	788	-3967
	(7613)	(8370)
D. NPV, STEM Majors (N=540)		
NPV of Profit	-762	-545
	(747)	(648)
Target State Tax Revenue	2990***	2037*
	(1021)	(1174)
United States Tax Revenue	7105	4844
	(6180)	(5714)
E. NPV, Non-STEM Majors (N=793)		
NPV of Profit	-935	-1110*
	(678)	(604)
Target State Tax Revenue	886	907
	(699)	(747)
United States Tax Revenue	1807	2510
	(4031)	(3359)
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Students are assigned residences based on their home mailing address.

Online Appendices

A Pre-Analysis Plan Appendix

A.1 Summary Statistics

The variables included in this project are (1) an indicator for being raised by a single parent, (2) a head count of a student's household size, (3) an indicator for no data on household size, (4) self-reported family income, (5) an indicator for having reported family income, (6) an indicator for being a first generation college student, (7) estimated age at college entry, (8) an indicator for no age data, (9) a student's best SAT or ACT equivalent score, (10) an indicator for no standardized test score, (11) a student's weighted high school GPA, (12) a student's overall admission score, (13) a financial aid application indicator, (14) an indicator for honors admission, (15) an indicator for receiving a separate merit scholarship offer, (16) an indicator for self-identifying as female, (17) a categorical variable for father's education, (18) a categorical variable for mother's education, (19) a categorical variable for the school/department of the major the student listed as their first preference, (20) a categorical variable for home country or region of a student's mailing address, (21) an overall academic rating of the student from the research university, (22) a holistic score, (23) a student's expected family contribution (EFC) value, (24) an indicator for no EFC data, and (25) a categorical variable for ethnic identity.[22] After completion of the project, the target university was able to provide records of students' American citizenship and permanent residency at the time of college application.[23]

[22]In the pre-analysis plan, I had pre-registered that variable number 11 was an unweighted GPA, but the target university instead provided weighted GPA. Variable 13 was intended to be an indicator for having filed a Free Application for Federal Student Aid (FAFSA), but the target university instead provided an indicator for applying for any form of financial aid.

[23]When the pre-analysis plan for the project was submitted, the target university had been using a noisy indicator it had retained for American citizenship. That indicator was not included in the PAP because of concerns about accuracy. After the project was completed, the target university discovered an another set of records for students in the 2011-2012 application cycle with detailed records on citizenship and provided an indicator of American citizenship or residency. Because this was not a pre-registered variable, I denote each place in the manuscript where the variable is used.

Table A.1: Full Sample Summary Statistics

	Mean	Min	Max
Raised by Single Parent	.1222806	0	1
Household Size	3.762191	2	12
No Household Size	.0705176	0	1
Family Income	194196	0	999999
No Income Report	.1327832	0	1
First Generation	.1965491	0	1
Age at Entry	18.80683	16.35089	22.07042
No Age Data	.0157539	0	1
Best SAT/ACT	1850.048	1040	2400
No SAT Score	.0255064	0	1
GPA	3.866174	1.72	4.38
Admission Score	244.4756	164	300
Financial Aid Application	.2348087	0	1
Honors Student	.0435109	0	1
Merit Scholarship	.012003	0	1
Female	.5536384	0	1
Expect Family Contribution	22371.02	0	99999
Origin: Americas	.0270068	0	1
Origin: China	.4553638	0	1
Origin: Europe or Africa	.0067517	0	1
Origin: Korea	.0802701	0	1
Origin: Other Asia or Oceania	.0892723	0	1
Origin: US, Same Region	.2370593	0	1
Origin: US, Other Region	.1042761	0	1

Note: Family income and expected family contribution are measured in dollars and are top-coded at values of 999,999 dollars per year and 99,999 dollars respectively. These values represent students with family incomes and expected familiy contributions above the respective ceilings rather than students with missing data.

A.2 Pre-specified Balance Tests

Table A.2: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
Raised by Single Parent	0.0113
	(0.0120)
Household Size	-0.0149
	(0.0386)
No Household Size Data	-0.0064
	(0.0093)
Reported Family Income	-1.80e+04**
	(7398.2816)
No Reported Income	0.0113
	(0.0130)
First Generation Student	-0.0218
	(0.0149)
Age at College Entry	0.0297
	(0.0242)
No Age Reported	-0.0000
	(0.0040)
Best SAT Score	0.4631
	(8.1583)
No SAT Score	0.0050
	(0.0056)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.3: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
Weighted GPA	0.0099
	(0.0089)
Admission Score	-0.0463
	(0.8269)
FAFSA Indicator	-0.0028
	(0.0157)
Honors Student	0.0050
	(0.0075)
Merit Scholarship	-0.0013
	(0.0042)
Female	0.0056
	(0.0188)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.4: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
dad==2-Year College Graduate	-0.0115
	(0.0083)
dad==4-Year College Graduate	0.0021
	(0.0184)
dad==High School Graduate	0.0088
	(0.0100)
dad==NULL	-0.0090
	(0.0086)
dad==No High School	-0.0051
	(0.0047)
dad==Postgraduate Study	0.0148
	(0.0177)
dad==Some College	0.0037
	(0.0097)
dad==Some High School	-0.0038
	(0.0060)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.5: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
mom==2-Year College Graduate	0.0075
	(0.0105)
mom==4-Year College Graduate	-0.0005
	(0.0187)
mom==High School Graduate	0.0011
	(0.0124)
mom==NULL	-0.0026
	(0.0086)
mom==No High School	-0.0064
	(0.0052)
mom==Postgraduate Study	0.0175
	(0.0151)
mom==Some College	-0.0064
	(0.0107)
mom==Some High School	-0.0102*
	(0.0053)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.6: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
major==Interdisciplinary	0.0013
	(0.0022)
major==None	0.0263
	(0.0160)
major==Life Science	-0.0090
	(0.0118)
major==Arts	0.0012
	(0.0065)
major==Humanities	0.0025
	(0.0078)
major==Physical Science	-0.0116
	(0.0118)
major==Social Science	-0.0244
	(0.0151)
major==Engineering	0.0151
	(0.0124)
major==Management Science	-0.0001
	(0.0087)
major==Nursing Science	-0.0013
	(0.0013)
major==Pharmacy Science	-0.0026
	(0.0044)
major==Computer Science	-0.0051
	(0.0079)
major==Public Health	0.0025
	(0.0031)
major==Other	0.0050
	(0.0059)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.7: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
home==Americas	-0.0038
	(0.0065)
home==China	-0.0057
	(0.0189)
home==Europe or Africa	-0.0013
	(0.0028)
home==Korea	-0.0039
	(0.0100)
home==Other Asia or Oceania	0.0050
	(0.0111)
home==US - Far	0.0010
	(0.0159)
home==US - Near	0.0087
	(0.0116)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.8: Association between Tuition Waiver Size and Pre-Treatment Demographics

Outcome	(1)
ethnic==African-American or Black	-0.0076
	(0.0047)
ethnic==American Indian	-0.0013
	(0.0013)
ethnic==Caucasian or White	0.0252*
	(0.0129)
ethnic==Chicano/Mexican-American	0.0025
	(0.0044)
ethnic==Chinese/Chinese-American	-0.0083
	(0.0189)
ethnic==Declined To State	-0.0013
	(0.0072)
ethnic==East Indian/Pakistani	-0.0013
	(0.0078)
ethnic==Japanese/Japanese-Americn	-0.0000
	(0.0044)
ethnic==Korean	-0.0065
	(0.0129)
ethnic==Latino/Oth Span-American	0.0012
	(0.0049)
ethnic==Other Asian	-0.0064
	(0.0052)
ethnic==Philipino or Filipino	0.0012
	(0.0058)
ethnic==Polynesian	-0.0025
	(0.0018)
ethnic==Vietnamese	0.0051
	(0.0050)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table A.9: Association between Tuition Waiver Size and Predicted Outcomes

Outcome	(1)
A. Enrollment	
Target University	-0.0008
	(0.0084)
Any Target State College	-0.0001
	(0.0068)
Any US College	0.0053
	(0.0066)
B. Migration	
Registered in Target State	0.0077*
	(0.0045)
Registered in United States	0.0100
	(0.0110)
C. Target State Labor Market	
Executives in Target State	0.0003
	(0.0012)
Innovators in Target State	0.0006
	(0.0013)
Entrepeneurs in Target State	0.0003
	(0.0005)
Salary in Target State	1.04e+04**
	(4653.0823)
D. US Labor Market	
Executives in United States	-0.0011
	(0.0021)
Innovators in United States	-0.0001
	(0.0020)
Entrepeneurs in United States	0.0003
	(0.0009)
Salary in United States	6196.4450
	(9606.4742)
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

A.3 Deviations from the Pre-Analysis Plan

I note the following deviations from the pre-analysis plan:

- I did not receive data on medium-run outcomes like college graduation and academic performance. Hence, these outcomes were not examined in the manuscript.
- Some variables had somewhat different definitions than was initially anticipated. For example, I received weighted rather than unweighted GPA. These differences are noted in Section 3.1 of the paper.
- I received a variable that was not pre-registered: a binary indicator for American citizenship or residency at the time of college application. I note that this variable was not included in the PAP each time I reference a result including it in the manuscript. In line with editor comments, I now test for heterogeneity using this variable.
- Estimates are per 10,000 dollars of nonresident tuition rather than per 1,000 dollars to make results more easily interpretable.
- The assumed state-level tax rate on earnings was reduced from 25 percent to 5 percent in Section 5. The 25 percent rate in the PAP was intended to reflect the rough rate of federal tax revenue as a share of GDP, but was inadvertently also listed at the state level. In most American states, tax revenue is roughly 5 percent of Gross State Product. This switch makes my results more conservative. Table 9 now includes both state and federal tax revenue estimates per editor comments.
- Specifications that look at each treatment arm separately were suggested by a referee.
- Estimates of effects on college enrollment decomposed by sector was suggested by a referee.
- In line with referee and editor comments I have added Tables 2, 3, 7, 8, B.2, B.3, D.1, D.2, C.6, C.8, C.12, C.7, C.9, C.13, C.10, C.11, 2, D.3, D.4, D.5.

A.4 Pre-specified Variable Definitions

This paper uses the following definitions for labor market outcomes that rely on Revelio Labs' records on the universe of LinkedIn profiles:

- LinkedIn Location: This is defined as the metropolitan area listed on LinkedIn profiles. This variable is set to the country listed on the profile if the metropolitan area is missing. These data come from Revelio Labs and manually collected LinkedIn records.
- LinkedIn Earnings: This is defined as the imputed earnings based on work history and job title from Revelio Labs dataset. In cases where this is absent, we will link job titles to the most similar BLS occupation code and its annual mean wages. These data will come from Revelio Labs and manually collected records. I assume students work for 20 years at a constant level of earnings in their recorded place of residence beginning 8 years after college application to be conservative. Earnings will be imputed for people without LinkedIn job titles by assuming an annual mean earnings level equal to the sample average estimated mean annual wage for students whose occupational titles are observed.

  In practice I use the following formula to calculate this, assuming earnings persist for 20 years after the initial year: $\text{NPV}_i = \sum_{t=8}^{28} \frac{\hat{w}_i}{(1+0.05)^t}$.
- LinkedIn Entrepreneurship: This is defined as having a relevant term in *any* part of the LinkedIn profile. The relevant terms are: Entrepreneur, Founder, Co-founder, Creator, Startup, Owner, CEO, Venture, Investor, or Strategist.
- LinkedIn Innovation: This is defined as having a relevant term in *any* part of the LinkedIn profile. The relevant terms are: Inventor, Patent, Innovation, Innovator, Developer, Development, Research, Scientist, Engineer, Technology/Technologist, Design, Data, Idea, or Lab/Laboratory.
- LinkedIn Executive Experience: This is defined as having a relevant term in *any* part of the LinkedIn profile. The relevant terms are: Chief, Officer, President, Director, Board, Executive, Chair/Chairman, Manager/Management/Managing, Partner, Head, Lead, or Senior.

B Extensions and Mechanisms

B.1 Decomposition of Enrollment by Sector

Table B.1: Enrollment Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Enrollment by Institution Types		
No US College	-0.0156	-0.0110
	(0.0175)	(0.0173)
Non-AAU US Campus	-0.0103	-0.0149
	(0.0116)	(0.0108)
Public AAU Campus	0.0374**	0.0411**
	(0.0189)	(0.0190)
Private AAU Campus	-0.0115	-0.0152
	(0.0096)	(0.0097)
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

B.2 Retention of Inframarginal Students

Table B.2: Migration Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)
A. Registered in State after 12 Years	
Registered in Target State	0.0329***
	(0.0108)
B. Expected from Enrollment Increase	
In-Sample Data	0.0026***
	(0.0010)
Literature (Midpoint)	0.0074***
	(0.0028)
Literature (Max)	0.0144***
	(0.0055)
Controls	No
Sample Size	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Registration refers to appearing in the voter registration rolls of the corresponding location, which requires American citizenship and covers roughly three quarters of all American citizens. "In-Sample Data" refers to a calculation of the rate of migration attrituable to the rise in enrollment in the target state using in-sample data on transition rates from in-state enrollment to target state migration from the 20,000 dollar treatment arm. "Literature (Midpoint)" refers to a calculation of the rate of migration attrituable to the rise in enrollment in the target state using the midpoint among papers cited in (Beine et al., 2023). "Literature (Max)" refers to a calculation of the rate of migration attrituable to the rise in enrollment in the target state using the maximum among papers cited in (Beine et al., 2023).

Table B.3: Association between Transition Rate and Tuition Waivers per 10,000 Dollars

Outcome	(1)
A. Registered in Target State after 12 Years	
	[Baseline: 0.0919]
Registered in Target State	0.0567***
	(0.0193)
Controls	No
Sample Size	608

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Transition Rates" refer to the share of students who migrate to the target state conditional on having enrolled at a college or university in the target state in 2012. The sample is restricted to students who enrolled in the target state in the Fall Term of 2012.

B.3 Estimates by Treatment Arm

While the primary analysis estimates treatment effects linearly across waiver size, disaggregating the effects by treatment arm reveals meaningful heterogeneity that informs both mechanisms and external validity. Tables B.4 through B.8 report separate estimates for the 20,000 dollar, 30,000 dollar, and 40,000 dollar treatment arms.

Table B.4 presents short-run enrollment outcomes. Effects on enrollment at the target university and other institutions within the state are larger when comparing the 30,000 dollar and 40,000 dollar arms than when comparing the 20,000 dollar and 30,000 dollar arms. This pattern suggests a convex demand curve, with student enrollment more responsive on a per-dollar basis at lower net prices. In contrast, when examining enrollment at any college or university within the United States, the effects are larger between the 20,000 dollar and 30,000 dollar treatment arms, with negligible or even negative effects from increasing the waiver from 30,000 dollars to 40,000 dollars. This could reflect differences in students' counterfactual options at higher willingness to pay levels or behavioral effects of large tuition discounts altering students' perceptions of campus quality (e.g., Veblen effects). The correspondence of these patterns with later residence outcomes reduces the likelihood that they are attributable solely to estimation noise.

Table B.5 presents effects on long-run in-state residence. Migration to the target state increases with the size of the waiver, but while the 40,000 dollar treatment arm yields the largest effect in magnitude, the marginal gain from 30,000 to 40,000 dollars is smaller than the gain from 20,000 to 30,000 dollars, suggesting possible diminishing returns. Residence anywhere in the United States follows an identical pattern to college enrollment in the United States twelve years earlier, again suggesting that students on the margin of migrating to the United States have a much higher willingness to pay.

Tables B.6 and B.7 report effects on labor market outcomes in the target state and the United States as a whole. The largest increases in executive and innovator migration to the target states occur in the 30,000 dollar treatment arm, with smaller, but still statistically significant, effects at 40,000 dollars. These patterns are consistent with concave externalities: the students most likely to generate long-run labor market spillovers appear to be those with relatively high willingness to pay and are most responsive at intermediate levels of tuition relief. Across all treatment arms, labor market outcomes in the United States remain null, consistent with the results from the linear specification.

Table B.8 presents results for the net present value of labor market earnings. In the target state, the increase in long-run earnings is substantially larger for students in the 30,000 dollar treatment arm than for those in the 40,000 dollar arm, despite both being statistically significant. This again points to diminishing marginal returns and suggests that the long-run externalities are driven more by the retention of students already inclined to enroll than by expansion at the margin. While the linear specification showed no significant earnings gains in the United States overall, disaggregating by treatment arm reveals that the 30,000 dollar group does exhibit meaningful increases in national labor market earnings. These patterns align closely with earlier results for U.S. college enrollment and migration, reinforcing the idea that the students on the margin of remaining in the U.S. labor market have particularly high willingness to pay.

Taken together, these results suggest that the long-run effects of tuition waivers on migration and fiscal externalities are not simply a function of increased enrollment. Instead, they appear to operate through the retention of students who would have enrolled regardless but might otherwise have left the state after graduation. The results also imply that moving from no waiver to a 20,000 dollar waiver would likely generate even larger returns on a per-dollar basis than those observed in the experimental arms. By contrast, additional waivers beyond 30,000 dollars exhibit diminishing or flat marginal returns. These patterns point to the existence of an optimal level of nonresident supplemental tuition that maximizes the net public benefit from skilled migration while minimizing the institutional cost of foregone tuition revenue.

Table B.4: Enrollment Effects of Nonresident Tuition Waivers by Treatment Arm

	(1) Target U	(2) Target U	(3) State	(4) State	(5) USA	(6) USA
30,000 Dollars	0.0180	0.0289	0.0315	0.0429	0.0563*	0.0457
	(0.0253)	(0.0216)	(0.0333)	(0.0324)	(0.0306)	(0.0299)
40,000 Dollars	0.0558**	0.0611***	0.0867***	0.0927***	0.0277	0.0198
	(0.0263)	(0.0229)	(0.0333)	(0.0335)	(0.0310)	(0.0307)
Controls	No	Yes	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table B.5: Migration Effects of Nonresident Tuition Waivers by Treatment Arm

	(1) State	(2) State	(3) USA	(4) USA
30,000 Dollars	0.0450**	0.0317*	0.0653**	0.0384*
	(0.0185)	(0.0182)	(0.0283)	(0.0218)
40,000 Dollars	0.0583***	0.0477**	0.0378	0.0216
	(0.0191)	(0.0187)	(0.0278)	(0.0217)
Controls	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table B.6: Effect on Target State Migration of Nonresident Tuition Waivers by Arm

	(1) Executive	(2) Excutive	(3) Entrepeneur	(4) Entrepeneur	(5) Innovator	(6) Innovator
30,000 Dollars	0.1341***	0.1687***	0.0263	0.0276	0.1464***	0.1725***
	(0.0452)	(0.0487)	(0.0179)	(0.0196)	(0.0481)	(0.0531)
40,000 Dollars	0.1031**	0.1175***	0.0154	0.0118	0.0896**	0.0950**
	(0.0419)	(0.0423)	(0.0146)	(0.0135)	(0.0437)	(0.0437)
Controls	No	Yes	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table B.7: Effect on United States Migration of Nonresident Tuition Waivers by Arm

	(1) Executive	(2) Excutive	(3) Entrepeneur	(4) Entrepeneur	(5) Innovator	(6) Innovator
30,000 Dollars	-0.0505	-0.0309	-0.0046	0.0014	0.0175	0.0463
	(0.0617)	(0.0586)	(0.0296)	(0.0327)	(0.0621)	(0.0618)
40,000 Dollars	-0.0875	-0.0844	0.0042	-0.0021	-0.0124	-0.0138
	(0.0595)	(0.0581)	(0.0298)	(0.0298)	(0.0603)	(0.0582)
Controls	No	Yes	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table B.8: Profit and Earnings Effects of Nonresident Tuition Waivers by Treatment Arm

	(1) Profit	(2) Profit	(3) State	(4) State	(5) USA	(6) USA
30,000 Dollars	-827.72	-400.27	85092.25***	72641.24***	65446.29**	44041.75**
	(970.27)	(818.07)	(24867.37)	(24328.56)	(26334.43)	(21607.69)
40,000 Dollars	-1480.80*	-1264.00	60590.59***	45267.44**	26001.31	16277.31
	(893.89)	(777.16)	(20744.35)	(21775.59)	(24695.45)	(21125.85)
Controls	No	Yes	No	Yes	No	Yes
Sample Size	1,333	1,333	1,333	1,333	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Profit refers to the university's revenue less instructional expenditures. Columns titled State and USA refer to the present value of earnings in the respective locations.

C Heterogeneous Treatment Effects

C.1 Pre-Specified HTE

Heterogeneous treatment effects in this appendix are tested along two pre-specified dimensions: country of home address and STEM major intent at the time of college application. I begin by generating tables with identical outcomes and specifications to Table 9 that estimate effects separately for (1) all nonresident students with a primary home address in China, Taiwan, or Hong Kong in Table C.1. These students are close to half the full sample (45 percent). Next, I turn to all nonresident students with a primary home address outside of the United States (66 percent of the sample) in Table C.2, and all nonresident students with a primary home address in the United States (33 percent of the sample) in Table C.3. I caution that primary home address in this case does not align perfectly with citizenship nor with domestic out-of-state or foreign student status.

Across these tables I note that point estimates suggest more mobility between states for nonresident students with a domestic home address and more mobility between countries for nonresidents with an international address, especially among students with a home address in China. However, given that I cannot reject the null hypothesis that these results are the same across groups, I interpret these findings to imply that my results are relatively similar regardless of a student's place of origin.[24]

With regard to STEM major intent, I split the sample into STEM and non-STEM major groups based on whether their first preference major at the research university is a CIP-designated STEM major by the US Department of Homeland Security. This is a useful measure of STEM status because the ease of immigration and labor market participation laws in the United States is relaxed for students completing a CIP designated STEM major (Amuedo-Dorantes et al., 2020; Beine et al., 2023).

Results are shown for STEM students in Table C.4 and Non-STEM students in Table C.5. Consistent with the theoretical prediction that STEM students are more mobile because of the greater ease of immigration under US law and consistent with higher expected earnings for STEM workers, results are stronger among students with STEM major intent. Every 10,000 dollars in tuition waiver offers to students intending to major in STEM costs the target university 760 dollars in short-run profit but returns 59,800 dollars in discounted earnings to the state in which the target university resides. This finding suggest that streamlining

[24]In a test of heterogeneous treatment effects that uses a variable that was not anticipated and included in the PAP, I find that there are significantly (t-statistic 2.31) larger effects on earnings within the target state's labor market from students who were citizens or American legal permanent residents at the time of college application.

immigration laws and reducing nonresident tuition can be complementary policies. Places seeking to attract skilled workers can reduce both the financial and bureacratic barriers to immigration simultaneously, raising longer-run migration at comparatively low short-run costs.

Table C.1: Effects of Tuition Waivers per 10,000 Dollars among Chinese Residents

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-1724**	-1996***
	(811)	(726)
B. NPV of Earnings in the Target State		
Salary in Target State	24155	30938*
	(15839)	(17448)
C. NPV of Earnings in the United States		
Salary in United States	15964	28969**
	(10901)	(12508)
Controls	No	Yes
Sample Size	607	607

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table C.2: Effects of Tuition Waivers per 10,000 Dollars among International Nonresidents

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-1212*	-1222**
	(653)	(564)
B. NPV of Earnings in the Target State		
Salary in Target State	17543	14847
	(13044)	(13961)
C. NPV of Earnings in the United States		
Salary in United States	13824	20242**
	(9183)	(9821)
Controls	No	Yes
Sample Size	878	878

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table C.3: Effects of Tuition Waivers per 10,000 Dollars among Domestic Nonresidents

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	7	346
	(748)	(735)
B. NPV of Earnings in the Target State		
Salary in Target State	63207***	36070
	(22887)	(26959)
C. NPV of Earnings in the United States		
Salary in United States	3154	-15866
	(30451)	(33480)
Controls	No	Yes
Sample Size	455	455

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table C.4: Effects of Tuition Waivers per 10,000 Dollars among STEM Majors

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-762	-545
	(747)	(648)
B. NPV of Earnings in the Target State		
Salary in Target State	59795***	40739*
	(20429)	(23485)
C. NPV of Earnings in the United States		
Salary in United States	28421	19378
	(24719)	(22854)
Controls	No	Yes
Sample Size	540	540

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table C.5: Effects of Tuition Waivers per 10,000 Dollars among Non-STEM Majors

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-935	-1110*
	(678)	(604)
B. NPV of Earnings in the Target State		
Salary in Target State	17717	18135
	(13983)	(14939)
C. NPV of Earnings in the United States		
Salary in United States	7228	10039
	(16125)	(13437)
Controls	No	Yes
Sample Size	793	793

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

C.2 HTE Enabled by Additional Data

Tables C.6 through C.13 illustrate heterogeneous treatment effects for each of the main outcomes of interest with the sample split between nonresident students who were or were not American nationals at the time of college application. American nationals are defined as being anyone who was either a citizen or a legal permanent resident when they applied to the target university. The distinction between the two dimensions of place of residence and nationality is nontrivial both in terms of numbers and policy implications. For example, 14 percent of "out-of-state" students are neither American citizens nor green card holders, meaning that they are essentially international students whose families recently relocated to the United States. Likewise, 11 percent of "international" students are Americans citizens who were raised/living abroad and are returning to the United States for college.

The effects of tuition waivers on enrollment and eventual migration to the target state are driven overwhelmingly, if not entirely, by nonresident students who were citizens or legal permanent residents at the time of college application (American nationals who are nonresidents). American national nonresidents are more sensitive to small changes in prices when deciding where to enroll and their transition rate (migration rate conditional on enrolling) is also far more sensitive to prices.

A clear policy implication from this result is that the general policy of charging identical nonresident supplemental fees to American nationals and non-American nonresidents is unlikely to be welfare maximizing. Adding another degree of price discrimination between these two groups could recover greater profits for universities to cross-subsidize local residents while simultaneously improving the skills available in the local labor market and/or the budget balance of the state government relative to status quo policy.

Table C.6: Effects of Tuition Waivers on American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Enrollment at Target University		
	[Baseline: 0.1161]	
Target University	0.0383*	0.0600***
	(0.0227)	(0.0206)
B. Enrollment Anywhere in the Target State		
	[Baseline: 0.3419]	
Any Target State College	0.0786**	0.0806**
	(0.0311)	(0.0336)
C. Enrollment Anywhere in the United States		
	[Baseline: 0.8774]	
Any US College	0.0084	-0.0039
	(0.0204)	(0.0223)
Controls	No	Yes
Sample Size	488	488

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "American Nonresidents" refers to the subsample of students who were American nationals, either citizens or permanent residents, but were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table C.7: Effects of Tuition Waivers on Non-American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Enrollment at Target University		
	[Baseline: 0.1869]	
Target University	0.0283	0.0228
	(0.0192)	(0.0168)
B. Enrollment Anywhere in the Target State		
	[Baseline: 0.4567]	
Any Target State College	0.0333	0.0363
	(0.0235)	(0.0242)
C. Enrollment Anywhere in the United States		
	[Baseline: 0.5709]	
Any US College	0.0180	0.0159
	(0.0232)	(0.0241)
Controls	No	Yes
Sample Size	845	845

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Non-American Nonresidents" refers to the subsample of students who were not American nationals, either citizens or permanent residents, and were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table C.8: Effects of Tuition Waivers on American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Registered in Target State after 12 Years		
	[Baseline: 0.1548]	
Registered in Target State	0.0911***	0.0769***
	(0.0266)	(0.0296)
B. Registered in the United States after 12 Years		
	[Baseline: 0.5548]	
Registered in United States	0.0438	0.0184
	(0.0313)	(0.0349)
Controls	No	Yes
Sample Size	488	488

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "American Nonresidents" refers to the subsample of students who were American nationals, either citizens or permanent residents, but were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table C.9: Effects of Tuition Waivers on Non-American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Registered in Target State after 12 Years		
	[Baseline: 0.0104]	
Registered in Target State	0.0000	0.0030
	(0.0048)	(0.0040)
B. Registered in the United States after 12 Years		
	[Baseline: 0.0104]	
Registered in United States	0.0059	0.0087*
	(0.0058)	(0.0052)
Controls	No	Yes
Sample Size	845	845

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Non-American Nonresidents" refers to the subsample of students who were not American nationals, either citizens or permanent residents, and were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000).

Table C.10: Effects of Tuition Waivers on American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Located in Target State after 12 Years		
	[Baseline:	*0.1871]*
Located In-State (2024)	0.0872***	0.0681**
	(0.0277)	(0.0310)
B. Located in the United States after 12 Years		
	[Baseline:	*0.6516]*
Located in America (2024)	0.0215	-0.0063
	(0.0300)	(0.0322)
Controls	No	Yes
Sample Size	488	488

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "American Nonresidents" refers to the subsample of students who were American nationals, either citizens or permanent residents, but were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000). "Located In-State" refers to being recorded in the target state in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles. "Located in America" refers to being recorded in the United States in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles.

Table C.11: Effects of Tuition Waivers on Non-American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. Located in Target State after 12 Years		
	[Baseline: 0.0484]	
Located In-State (2024)	0.0041	0.0034
	(0.0105)	(0.0103)
B. Located in the United States after 12 Years		
	[Baseline: 0.1453]	
Located in America (2024)	-0.0014	0.0023
	(0.0165)	(0.0171)
Controls	No	Yes
Sample Size	845	845

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Non-American Nonresidents" refers to the subsample of students who were not American nationals, either citizens or permanent residents, and were not in-state students at the time of college application. "Baseline" refers to the mean value of the outcome variable for the smallest tuition waiver treatment arm ($20,000). "Located In-State" refers to being recorded in the target state in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles. "Located in America" refers to being recorded in the United States in 2024 using a combination of voter registration records and data scraped from the universe of LinkedIn profiles.

Table C.12: Effects of Tuition Waivers on American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-205	502
	(758)	(669)
B. NPV of Earnings in the Target State		
Salary in Target State	73821***	52546*
	(24485)	(29022)
C. NPV of Tax Revenue in the Target State		
Target State Tax Revenue	3691***	2627*
	(1224)	(1451)
D. NPV of Earnings in the United States		
Salary in United States	26451	7140
	(29360)	(34185)
E. NPV of Tax Revenue in the United States		
United States Tax Revenue	6613	1785
	(7340)	(8546)
Controls	No	Yes
Sample Size	488	488

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "American Nonresidents" refers to the subsample of students who were American nationals, either citizens or permanent residents, but were not in-state students at the time of college application. Profit refers to the difference between net tuition paid by the student and estimated instrucitonal expenditures. Salary refers refers to an indicator for location interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.

Table C.13: Effects of Tuition Waivers on Non-American Nonresidents per 10,000 Dollars

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-1161*	-1336**
	(657)	(581)
B. NPV of Earnings in the Target State		
Salary in Target State	11679	12078
	(11163)	(12520)
C. NPV of Tax Revenue in the Target State		
Target State Tax Revenue	584	604
	(558)	(626)
D. NPV of Earnings in the United States		
Salary in United States	5622	9244
	(5739)	(6579)
E. NPV of Tax Revenue in the United States		
United States Tax Revenue	1406	2311
	(1435)	(1645)
Controls	No	Yes
Sample Size	845	845

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. "Non-American Nonresidents" refers to the subsample of students who were not American nationals, either citizens or permanent residents, and were not in-state students at the time of college application. Profit refers to the difference between net tuition paid by the student and estimated instrucitonal expenditures. Salary refers refers to an indicator for location interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.

D Robustness Checks

Table D.1: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Full Sample Outcomes (N=1,333)		
Registered in Target State	0.0329***	0.0268**
	(0.0108)	(0.0105)
Salary in Target State	34151***	25302**
	(11718)	(12314)
B. Subsample with Income <$250K (N=1,073)		
Registered in Target State	0.0310**	0.0268**
	(0.0127)	(0.0124)
Salary in Target State	33087**	28485**
	(13519)	(14103)
Controls	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Registration refers to appearing in the voter registration rolls of the corresponding location, which requires American citizenship and covers roughly three quarters of all American citizens.

Table D.2: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Linear Control for Income		
Registered in Target State	0.0329***	0.0268**
	(0.0108)	(0.0105)
Salary in Target State	34151***	25302**
	(11718)	(12314)
B. Quadratic Control for Income		
Registered in Target State	0.0329***	0.0268**
	(0.0108)	(0.0105)
Salary in Target State	34151***	25250**
	(11718)	(12297)
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Registration refers to appearing in the voter registration rolls of the corresponding location, which requires American citizenship and covers roughly three quarters of all American citizens.

Table D.3: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. NPV of Profit for Target University		
NPV of Profit	-835*	-714
	(504)	(438)
B. NPV of Earnings and Tax Revenue in Target State		
75% of Salary in Target State	25614***	18976**
	(8788)	(9235)
75% of Tax in Target State	1281***	949**
	(439)	(462)
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Profit refers to the difference between net tuition paid by the student and estimated instrucitonal expenditures. Salary refers refers to an indicator for location interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.

Table D.4: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. Public Profile on LinkedIn		
On LinkedIn	-0.0118	-0.0096
	(0.0175)	(0.0178)
Controls	No	Yes
Sample Size	1,333	1,333

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses.

Table D.5: Effects of Nonresident Tuition Waivers per 10,000 Dollars

Outcome	(1)	(2)
A. NPV of Earnings in the Target State		
Salary in Target State	63028**	57882*
	(28772)	(32486)
B. NPV of Tax Revenue in the Target State		
Target State Tax Revenue	3151**	2894*
	(1439)	(1624)
C. NPV of Earnings in the United States		
Salary in United States	19584	35441
	(29756)	(27129)
D. NPV of Tax Revenue in the United States		
United States Tax Revenue	4896	8860
	(7439)	(6782)
Controls	No	Yes
Sample Size	397	397

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity robust standard errors in parentheses. Profit refers to the difference between net tuition paid by the student and estimated instrucitonal expenditures. Salary refers refers to an indicator for location interacted with estimated taxable earnings from Revelio Labs using job titles, work history, and employer, with imputed values for missing observations following this paper's pre-analysis plan. All values are discounted at a 5 percent annual rate consistent with this paper's pre-analysis plan.